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ABSTRACT

This compilation of essays and papers in French and English written in tribute to Bjorn Tell, covers various aspects of library and information services from an international perspective, including university libraries, librarianship, research, technology, reference, and organization of information. Articles focus on Berzelius, father of scientific abstract and reference literature in natural sciences, and such areas of research as information searching and library use in higher education, the effects of computer information services in a federal university, library staff and space utilization, student attitudes toward the library, the library role in higher education, and a comparison of user and documentalist reference work. Discussions of information theory include national cooperation of university libraries, bibliographic references in research communication, professional conduct in research, psychomethodological terms, the role of information professionals and librarians, technological change, and vocabulary structure. A brief review of Tell's career and a bibliography of his publications are included. (CWM)

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Knowledge and Development

Reshaping Library and Information Services for the World of Tomorrow

A Festschrift for Björn Tell

Edited by
Stephan Schwarz & Uno Willers

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STOCKHOLM
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1978

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EDITORS' PREFACE

This publication is conceived as a tribute to Björn Tell on his 60th birthday, September 23, 1978. In soliciting contributions we have made allowance for a broad interpretation of the concept of "library and information services". The world-wide provenance of the authors is symptomatic of the jubilee-celebrator's perspectives and working connections. Someone has glossed upon Björn Tell for the unusual intensity of his international commitments by attributing to him the label "for export only". But it is unanimously agreed that, through these very activities, he has been conveying fundamental results and seminal impulses to librarianship in his home country.

Librarianship is in fact badly in need of innovators. It is exactly in this capacity that Björn Tell has made his appearance on the national and international scene, with a remarkable capacity for penetrating barriers and breaking new ground. He has always been playfully fascinated by the potentialities of computer and communications technology for applications in library management and information & documentation services. An important contribution to the tremendous development in this area over the last two decades has been made by international co-operative projects and by co-ordinative efforts within organizations like OECD and UNESCO, where Björn Tell has played a prominent role. And a significant achievement has been to make the library world and the funding agencies appreciative of new needs and new options.

Jointly with all the contributors to this volume and all signees on the tabula gratulatoria we hereby present our cordial congratulations.

Stockholm in September 1978

Stephan Schwarz Uno Willers

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The editors wish to express their thanks to all contributing authors for excellent co-operation from the conception of this volume throughout the final stages of proof reading.

The entire camera-ready manuscript has been prepared in a very short time period by Berit Lundberg on a Xerox 800 text processing machine. The computer program system for creating the bibliographic file and for producing the printout has been designed and written by Stefan Svanström. Due credit and appreciation is given for their work, performed with remarkable professional skill.

The book has been produced by Liber Publ. Co., Stockholm, and we are indebted to Susan Nilsson for the artistic design and Lena Sandberg for production administration.

We finally wish to thank Lillemor Tell for permission to reproduce her portrait of Björn Tell.

BERZELIUS, FATHER OF SCIENTIFIC ABSTRACT AND REFERENCE LITERATURE IN THE NATURAL SCIENCES

A NOTEWORTHY EPISODE IN THE HISTORY OF THE ROYAL SWEDISH ACADEMY OF SCIENCES

By Wilhelm Odelberg

It is of course good that a Festschrift should have a connecting theme. For a volume of essays in honour of Björn Tell nothing could be more appropriate than a title which points like a spearhead right into the future: Reshaping Library Service for the World of Tomorrow. Let us hope that tomorrow's research libraries will be yet more efficient than those of today and that electronic and other aids will enable librarians to cope adequately with the flood of information which threatens to drown science or stifle it in its own abundance. Today such problems are evident to everybody. Thirty years ago, when I first met Björn Tell, the situation was not viewed quite so seriously. Björn, however, saw clearly how things were shaping and he took a number of initiatives. One result of these initiatives was the setting up of the National Committee for Documentation in 1963. Björn Tell became chairman and I myself secretary of this body, which formed part of the organization of the Royal Swedish Academy of Sciences. The National Committee continued in its original form for six years, after which its activities were taken over by the National Council for Information and Documentation (Statens råd för information och dokumentation, SINFDOK). At the time of writing the lastmentioned body is expected to undergo a radical organizational change in the near future.

I have sometimes discreetly suggested to Björn that a knowledge of the past gives a better understanding of the present and the future. I am not sure whether he altogether agrees with me about this. But at any rate I have not been contradicted, as has sometimes been the case when discussing with him problems concerning more recent scientific information. It may therefore be appropriate if in paying tribute to Björn Tell with this paper I write something about a chapter in the history of Swedish scientific information which is probably not very generally known.

When in 1970 the celebrated Swedish physicist Hannes Alfvén received the Nobel prize, the award was as usual commented on at length in the periodical "Science". The author of the article noted that Alfvén had during the earlier part of his career been "compelled" to publish his pioneering work in "obscure publications" such as the Transactions of the Royal Swedish Academy of Sciences (Svenska Vetenskapsakademiens Handlingar). Although, semantically, the English loan-word from the Latin obscurus does not have the same derogatory implication as its Swedish counterpart, there were many in Sweden who raised their eyebrows at its use in this connection. This reaction was due not least to the fact that for nearly 250 years the Transactions of the Swedish Academy of Sciences have played a by no means insignificant role in the international exchange of scientific information. There has sometimes been discussion of the strange phenomenon that during the 17th and 18th centuries, when communications were slow and often dangerous, there existed a unitary European culture in the scientific intercourse, based largely on the use of Latin.

By contrast, the later development, with all its technological innovations, has had a markedly divisive effect. Such phenomena as, for example, cover-to-cover tranlations would have been inconceivable in the old world. In the vanguard of the march towards Babel was the Royal Society in London, which in 1660 began to publish its proceedings and other writings in the vernacular. Shortly afterwards (1666) the Académie Royale des Sciences in Paris published its communications in French, and it was not long before Italian and German learned societies contributed to the confusion of tongues. When in 1739 the Swedish Academy of Sciences decided that its publications should be written in Swedish, it certainly extended its Swedish readership - the quarterly issues of the Transactions with useful papers on various subjects were in great demand in many quarters - but at the same time it could scarcely have failed to be realized that the international impact of the Transactions was, to say the least, limited. The great international libraries, however, recognize no language barriers. As early as 1749 the Swedish Academy of Sciences reached an agreement with the Royal Society in London on a full exchange of each other's publications.

For the Swedish Academy of Sciences it was a matter of prime concern that its work should be known internationally. As early as the beginning of the 1760s the Academy examined the possibility of publishing its Transactions in German or French under its own aegis. By that time, however, steps had already been taken abroad, without any initiative on the part of the Swedish Academy itself, to ensure that its writers became known. Foreign interest in the Academy's work was, however, by no means limited to the output of such internationally known celebrities of the time as Linnaeus, Celsius, Wargentin and Scheele. Earlier the contents of the Academy's publications were largely in the domains of medicine, technology and political economy. These writings were widely translated and reported despite the fact that many of the authors were quite unknown outside Sweden. It is not surprising that at first it was the German translations that played the most important role in this activity. Up to 1816 there existed a German-speaking population of high cultural standard under Swedish rule. The soil for Swedish-German cultural relations was particularly fertile in Swedish Pomerania and adjoining parts of northern Germany. For this reason many of the German translations of works by the Academy's authors were published in Pomerania. It is also natural that the German translations should have formed the bridge between the Academy's Transactions and other international languages. Many of the Academy's writings appeared in German long after the publication of the Swedish originals - in many cases five years or more later. After that several more years might elapse before the works were translated into other languages. In the 18th century the demand for up-to-dateness was evidently not as strong as it is nowadays. It can be established that translations or abstracts of publications of the Royal Swedish Academy of Sciences appeared in German, French, English, Latin, Danish-Norwegian, Dutch and Russian up to the middle of the 19th century. Then the Academy itself began to publish in foreign languages its Transactions, which at that time took the form of large scientific monographs. I do not propose to deal with this subject in detail here, as it has been treated exhaustively by my predecessor Arne Holmberg in the Academy's Yearbook (K. Vetenskapsakademiens Årsbok) for 1939. Here I will only mention a few important series, such as that published by the prominent German mathematician Abraham Gotthelf Kästner (1719-1800) under the title "Der Königl. Schwedischen Akademie Wissenschaften Abhandlungen aus der Naturlehre, Haushaltungskunst und Mechanik . . . Aus dem Schwedischen übersetzt". This series appeared until 1792, when Kästner discontinued it either because of advancing years or owing to the difficulty of finding competent assistants with a knowledge of Swedish. Among French translations and reports, particular interest attaches to the impressive volume published in 1772 under the title of "Mémoires de l'Académie royale des sciences de Stockholm concernant l'histoire naturelle, la physique, la médicine, l'anatomie, la chymie, l'oeconomie, les arts" etc. The translator, L.F.G. de Keralio (1731-93), who had a certain command of Swedish, was an officer and an instructor at the Ecole Royale Militaire in Paris. The volume, which consists of a summary of the first twenty-nine annual volumes of the Swedish Academy's Transactions, is arranged systematically according to the subjects botany, physics, astronomy, chemistry, medicine, political economy, commerce, agriculture and architecture. The collection is furnished with a detailed subject index.

In Holland, too, there was interest in translating the more noteworthy papers published by the Swedish Academy of Sciences. This interest resulted in the publication of two series. The first was issued by F. Houttuyn in 10 volumes under the title "Uitgezochte Verhandelingen uit de nieuwste Werken van de societeiten der Wetenschappen in Europa . . .", Amsterdam 1757-65.

This series contains many contributions, especially by Linnaeus and the celebrated entomologist Carl de Geer. The latter was a corresponding member of the French Academy of Sciences, which published several articles by him. These were later translated into Dutch. The medical officer of health at The Hague, J.B. Sandifort, arranged for the translation of a large number of the Swedish Academy's medical contributions of the period 1739-72 and printed them in four volumes with the title "Geneeskundige Verhandelingen aan de koninglijke zweedsche academie medegedeeld . . .", Leiden 1773-78.

Parts of the contents of the Academy's Transactions from the years 1739-52 were translated into Latin and were published in Venice in two volumes entitled "Analecta transalpina", 1762, together containing 194 papers. Two Russian scientific series also contained material from the Academy's Transactions. One of these series was "Trudy vol'nago ekonomičeskago obščestva", in which items began to appear in 1765; later, material was also published in the series Akademičeskija Izvestija, published by the Imperial Academy of Sciences in St Petersburg. Single papers by Swedish scientists published either in the Swedish Academy's Transactions or under the aegis of the Scientific Society of Uppsala were also translated into English and appeared in series published by English learned societies.

A large amount of the Swedish Academy of Sciences' non-periodical writings was even translated into the French and German languages. I have deliberately dwelt at some length on the international position which the Swedish Academy of Sciences occupied from the beginning, as reflected in the interest shown abroad in its published writings. Such a reminder may be appropriate, since in an otherwise interesting and informative work by David A. Kronick, "A History of Scientific and Technical Periodicals. The origins and development of the scientific and technological press 1665-1790", New York 1962, the author passes in complete silence over the Swedish contributions in the domain of science and information on these contributions. One may perhaps be allowed to guess that the author has shied away from a rather inaccessible language. But he should have noted the large quantity of translations. In a couple of chapters Kronick dwells at length on The Abstract Journal and The Review Journal. This is a field in which are charted both more or less ephemeral publications, very uneven in quality, and mathematical and scientific works of little note.

I now turn to the time, at the turn of the 18th and 19th centuries, when Jacob Berzelius comes upon the scene. The young man of that epoch who aspired to study physics or chemistry, or for that matter any other science, was highly dependent on guidance by talented teachers who took a real interest in their students. This guidance was far more vital for the student than the study of the literature in his subject. This applied with particular force to Berzelius, who attracted the attention of his teachers both at school and at the university.

During the years 1818-48 Berzelius was secretary of the Royal Swedish Academy of Sciences. It is not too much to say that during this period he made such an imprint on the Academy that the effects of his power of initiative and his strength of purpose are felt even in our own days. What Berzelius meant for the development of chemistry – the discovery of new elements, the determination of the atomic weights and the language of formulae in chemistry – all these are achievements which have an established and highly prominent place in the history of chemistry. It is, however, another aspect of Berzelius's activities that will be noted here.

On December 29, 1820, the Academy of Sciences adopted new basic rules. The work of revision had been preceded by heated discussions – one member who could not gain a hearing for his ideas resigned from the Academy. The new secretary, Berzelius, 40 years of age, already with a European reputation, and recently ennobled, made a number of important contributions. Berzelius had spent the academic year 1818-19 in Paris and had attended the ceremonial meeting of the French Academy. There he heard Cuvier deliver one of his reports, so much admired by contemporaries, on the progress made by natural scientists within the Academy's field of activities. Berzelius conceived the idea of introducing something similar as part of his plan to make the Swedish Academy more efficient and useful after his return. But the French Academy of Sciences, serving as it did a country of 30 million inhabitants, could be self-sufficient, whereas Sweden, at that time in many respects an underdeveloped country with a population not even one tenth that of France, could not be expected through its Academy of Sciences to dazzle the world with its own discoveries except on rare occasions. At the beginning of the 19th century, that is to say during the Napoleonic wars, scientific research and information existed under conditions which are almost inconceivable to us today. The Swedish censorship watched Argus-like over everything that was printed within Sweden and kept an equally jealous eye on foreign literature brought into the country. During his time as a physician and a young professor in Stockholm, Berzelius, together with a friend who shared his thirst for knowledge, wanted to form a reading circle which would subscribe to a number of foreign journals in the fields of physics, chemistry, anatomy and medicine. For this it was necessary to obtain permission from the Office of the Chancellor of the Court, headed by the all-powerful C.B. Zibet. Zibet, a zealous instrument for Gustaf IV Adolf's suppression of free speech, rejected the application out of hand. He pointed out that these young men had finished their studies at the university and that the Government expected them to use the knowledge they had acquired there and not to stuff their heads with newfangled, unnecessary and expensive knowledge which came from abroad. It was several years before Berzelius succeeded by other means in getting to Stockholm Gilbert's Annalen der Physik and Gehlen's Journal der Chemie.

One of the articles in the statutes adopted by the Swedish Academy of Sciences in 1820 provided for a ceremonial meeting to be held on March 31 every year. As a result of Berzelius's initiative, arrangements were now made for annual reports on the progress made in the natural sciences. These reports were to be clear and easy to understand and were to embrace all accessions to knowledge that the reporter considered worth presenting. Reference was to be made to all the literature dealing with science and related subjects. Medicine and agriculture were not included, as these subjects came under the Swedish Medical Association and the Royal Academy of Agriculture, respectively. Berzelius was, of course, aware that he alone could not be responsible for all these wide-ranging reports with their references to printed literature. But he relied on the senior officials at the National Museum of Natural History, which came under the Swedish Academy of Sciences, and especially on the head of the zoological collections, who was to report on works in the fields of comparative anatomy and zoology. He was similarly confident of the ability of the head of Stockholm Observatory, who also belonged to the Academy, to carry out the planned surveys. Professor Bergianus, who was in charge of the Academy's Botanical Garden, was to be responsible for the reports on all branches of botany.

In addition to chemistry, Berzelius took on his own shoulders physics (but see end of this paragraph), mineralogy and geology, although, as he later wrote, he did not consider himself to be more than a delettante in these three subjects. As regards technology, Berzelius was doubtful whether he would be able to induce the extremely self-willed and obstinate Professor G.M. Schwartz to produce annual reports on that subject. Berzelius's fears were confirmed - Schwartz dragged his feet in the first few reports - and it was not until Professor G.E. Pasch became head of the Academy's Institute of Physics that the reports on (physics and) technology reached a satisfactory standard. Pasch also relieved Berzelius of the task of producing reports on physics.

At first the annual reports were printed with continuous pagination, i.e. as parts of a single work. However, the principles of editing had soon to be altered, as the various authors seldom had their reports ready at the same time. It might therefore happen that the more diligent reporters had to wait an unconscionably long time before seeing their efforts in print. Consequently a change was made to individual pagination for each section and the reports on the different subjects could be sent separately for sale in the bookshops; in this way a researcher in a certian field did not have to pay for reports in which he had no interest. After some time these individual reports were furnished with subject - and author indexes, which of course made them much easier to use.

On March 31, 1821, - there took place the first ceremonial meeting in the history of the Swedish Academy of Sciences. - The occasion was celebrated with great pomp and circumstance in the then hall of ceremonies of the Academy in the Lefebure mansion, at Lilla Nygatan 13, Stockholm. Berzelius presented his annual reports in an address lasting only half an hour - a considerable feat of condensation, since in printed form the reports extended for 160 pages.

While it is clear that Berzelius's annual reports constitute the prototype for subsequent publications concerning scientific information, they have a number of features which are peculiar to themselves. Above all one is struck by the literary mode of presentation. Berzelius was eager that the necessarily compressed mass of information should be presented in such a way that it would make connected reading, so that the reports would not be used only for reference purposes. He himself wrote on one occasion that part of his intention in arranging for the annual reports was that they should stimulate the curiosity of the public and arouse a desire to know more and that, if possible, they should be so clear that even a reader who was not a trained scientist would not only become interested but also be able to understand the greater part of the contents.

Berzelius himself found the task of composing his annual reports extremely interesting and stimulating. He freely acknowledged that the self-imposed duty of going through innumerable foreign publications in order to be able to produce a satisfactory annual report on chemistry "enabled me to achieve a level of knowledge to which otherwise I should never have attained".

Another distinguishing feature of Berzelius's annual reports was that he not only summarized the publications but quite often added his own reflections. For a scientist with such a well-developed critical sense it was almost impossible to refrain from challenging statements which in his view were fallacious or obscure. Berzelius also had a more pedagogical justification for this policy. In his very first report on the advances in chemistry he stated that the series was intended primarily to be used by the young student. Consequently he took as his starting point his own textbook on chemistry, the annual reports being composed in such a way that they could be treated as supplements to that work. For this reason it was necessary to subject all literature reported to a critical scrutiny, "to point out probable inaccuracies and misleading statements in order thereby to accustom the young student not to have blind faith in everything that was printed in the scientific literature".

The criticisms contained in the reports meant, of course, that Berzelius acquired a number of enemies among those who felt the lash of his whip, but - particularly in view of the author's great authority - the reports were also received with tense interest and read attentively by the whole of the scientific world.

Berzelius himself was but little perturbed by the storms aroused by his attacks. For a man of his upright and uncomprising nature scientific truth as he conceived it was the only thing that mattered. There are many examples of this, but here it will suffice to mention one.

In 1825 the eminent Scottish chemist Thomas Thomson had published a work entitled "An Attempt to Establish the First Principles of Chemistry by Experiment". The conception of this work was ambitious, the author regarding it as representing the final fruits of his long labours, especially on atomic theory, and also as being the crown of his scientific career. Berzelius, in his annual report for 1826, demolished Thomson's book point by point and made the following devastating comment: "This work is among the few from which science has derived no gain. Much of the experimental content, including even the basic experiments, appears to have been elaborated only at the desk, and the greatest courtesy that his contemporaries can show the author is to consider this work as never having been published."

It is relevant to mention that in a printed dedication on the endpaper Thomson had included Berzelius's name. "It is an easy way out" wrote Berzelius "to purchase praise with praise. I have never resorted to it; instead in judging the works of others I have always served the best interests of science as I have understood them."

It is scarcely surprising that the annual reports presented by Berzelius and his colleagues to the Swedish Academy of Sciences aroused much attention. The well-known Swedish statesman Count H.G. Trolle-Wachtmeister, who was also a distinguished chemist, wrote to Berzelius: "Thanks to the orientation you have given them, the Academy's annual reports will introduce a new epoch in our scientific life."

For the same reasons which had caused the Academy's Transactions to reach a wide circle of readers, at least in German- and French-speaking areas, during the 18th century, its annual reports on the advances made by scientists aroused considerable attention. In Germany the task of making the reports accessible to German-speaking readers was at first shouldered by the well-known Professor, C.G. Gmelin of Tübingen and it was not long before the first volume of the reports appeared in a German translation. The translations, too, were, as has already been pointed out, received with considerable interest. Sometimes, however, the acclaim was mingled with protests and expressions of indignation. According to Berzelius a German chemist had fallen into the error of taking a certain copper-bearing earth, a tale, to be a new metal. This was mentioned, more or less in passing, by Berzelius in his first annual report. The chemist in question, understandably nettled, took his revenge by declaring in a review that Gmelin had done no service to science and to the German public by translating this "foreign product".

A circumstance of great importance for the dissemination of Berzelius's annual reports was his acquaintance with the young German chemist Friedrich Wöhler. The latter died in 1882, by which time chemical science had entered upon a new phase and Wöhler himself was regarded as the grand old man of chemistry, not only in Germany. In his youth in the 1820s Wöhler had worked in Berzelius's laboratory, where he enjoyed the master's favour and confidence. During his studies in Stockholm Wöhler soon learnt Swedish. He set to work on a translation into German of Berzelius's "Lärobok i kemien", a work which was constantly reprinted in new and expanded editions. So long as Berzelius lived it was Wöhler who saw to it that his ideas and results reached

Jahres-Bericht

über

die Fortschritte

der

physischen Wissenschaften

von

Jacob Berzelius.

Aus dem Schwedischen übersezt

von

C. G. Gmelin.

Erster Jahrgang.

Tübingen,
bei Heinrich Laupp.
1822.

new linguistic areas and at any rate were made available to the German-speaking public. With the annual reports of 1825 Wöhler also took over the translation of the volumes, Berzelius having become increasingly dissatisfied both with Gmelin and the printing house which produced Jahresbericht der Fortschritte.

But Wöhler, too, was to be placed in an invidious position by Berzelius's critical treatment in the annual reports of certain writings which in his opinion were of inferior quality. In Poggendorff's Annalen a Berlin physicist, G.F. Pohl, had published a paper entitled "Der Process der galvanischen Kette". In the annual report for 1826 Berzelius had dismissed this work with the following words: "If meaningless expressions and absurd comparisons could make up for deficiencies of matter and contents, the title of this work would be promising. As it is, one can only regret that there are some who do not realize that within the sciences there applies the well-known saying tamen est laudanda voluntas, the essence of which may be conveyed by the rather free translation 'the will to do something is not enough'." While Wöhler was engaged in his work of translation he received a visit from a common friend of his and Berzelius's, Th.J. Seebeck. Seebeck expressed the opinion that Pohl had been too harshly treated and advised Wöhler to omit the offending passage from the German edition and to replace it with dashes. Wöhler transmitted this suggestion to Berzelius and received the following reply: "Convey my greetings to Dr Seebeck and say that I hope I may be allowed to answer for myself for what I write and that there is no need for my friends to adopt the role of guardians and to leave things out and fill up the space with dashes. The proposal is absurd; I give you full authority to remove the whole account of Pohl's idiocy, but if it stays then my verdict on that rubbish also has a right to be printed. To mention it without criticism would be a crime against the sanctity of science. To pass over it altogether in silence as an expression of contempt I am, however, prepared to allow." The consequence was that the scathing criticism of Pohl's work did after all appear in "Jahresbericht der Fortschritte". Pohl for this part swore to be revenged. In his capacity of natural philosopher he was already in controversy with Berzelius and he therefore had the opportunity in the latter's Jahrbücher für wissenschaftliche Kritik to write in disparaging terms of Berzelius's textbook on chemistry. Berzelius's supporters and others who opposed the natural-philosophical school within the natural sciences accused Pohl of having "for reasons of personal revenge criticized a work for the evaluation of which he lacked the necessary scientific equipment". With these examples of odium academicum we can leave Wöhler and his work of translating the Swedish Academy of Sciences' annual reports on progress in chemical science.

Philippe Plantamour was a young Swiss who after a period with the celebrated Justus von Liebig of Giessen in 1838 had the unusual privilege of being accepted as an assistant in Berzelius's own laboratory. He quickly acquired a knowledge of Swedish and was soon entrusted with everything that the master wished to have translated into French. Thus Plantamour also took on the formidable task of translating the annual reports, beginning with the volume for 1840. The reports were published under the title "Rapport annuel par les progrès des sciences physiques et chimiques presenté le 31 mars . . . à l'Académie Royale des sciences de Stockholm, par J. Berzelius. Traduit du suédois sous les yeux de l'auteur", Paris 1-8, 1841-49. These annual reports in French, generally containing about 500 pages each, appeared as long as Berzelius lived, that is to say until 1848.

It is a noteworthy fact that the annual reports were never published in English. The reason for this is probably that during 1830 and the ensuing decade Berzelius became the target of criticism from English chemists and was far from popular among them. In 1812 Berzelius had visited England, where he had been received in the most cordial manner by the chemists in the Royal Society. He was soon on friendly terms with his English colleagues, especially Sir Humphry Davy. After a time, however, his relations with the latter deteriorated, Berzelius in his forthyright manner having criticized a work by Davy. I have dealt earlier with the controversy with Thomas Thomson. The new scheme of chemical formulation introduced by Berzelius did not

RAPPORT ANNUEL

SUR LES

PROGRÈS DES SCIENCES

PHYSIQUES ET CHIMIQUES

PRÉSENTÉ LE 31 MARS 1840

A L'ACADÉMIE ROYALE DES SCIENCES DE STOCKHOLM,

PAR

J. BERZELIUS,
Secrétaire perpétuel.

TRADUIT DU SUÉDOIS, SOUS LES YEUX DE L'AUTEUR,
PAR M. PLANTAMOUR.

PARIS,
FORTIN, MASSON ET C^{ie}, LIBRAIRES-ÉDITEURS,
1, PLACE DE L'ÉCOLE-DE-MÉDECINE.

1841.

readily find a foothold in England, where many recoiled from this radical change from the old familiar system. Gradually, however, after a special committee had come to the conclusion that no better system than Berzelius's could be conceived of, the English chemists, too, began to use it.

Berzelius's annual reports had no direct successors. After his time it was the indexes of the leading chemical journals that took over the greater part of the task of mediating international scientific information. Reports and abstracts as we know them today are a product of the first decades of the present century. Berzelius's attempt year by year to epitomize and evaluate the scientific output of his fellow-chemists is in itself extremely impressive. To undertake anything on this scale at the present time would be quite unthinkable without a huge staff. It is, moreover, highly unlikely that any scientific institution or publishing house would wish to take on the responsibility of publicly judging or criticizing the great ones of the earth in, for example, the field of chemistry with any claim to be uttering abiding truths.

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PSYCHOMETHODOLOGICAL TERMS (1)

By Sören Halldén

In his Lectures on Documentation (2) Björn Tell writes about the task of the documentalist: "He has to try to unify the different specialities, to bridge the gap between the sciences, so that something in astronomy that might be of interest in obstetrics is brought forward to the specialists in that field".

The present paper will be concerned with a gap in the conventional picture of the sciences. On the one hand, we have scientific methodology and the philosophy of science, branches of research in which the special sciences are subjected to a general scrutiny. On the other, we have the behavioural sciences, of which we will be chiefly occupied with education.

In customary schemes of classification, scientific methodology is assigned a place close to mathematics, as one of the most general subjects. Behavioural science enters the picture in the middle of the hierarchical ladder, or at the other end of it. From the conventional point of view, these branches are far apart. Admittedly, a theory of scientific method will have applications in all fields of intellectual inquiry. It is less obvious that many terms in behavioural science contain references to methodology, and that methodology is involved in their application.

Suppose that someone should publish a work on "The Motivation of Historical Education". Where would the librarian put it? Or suppose that the latter is confronted with a volume entitled "How to Avoid Superficiality in Your Studies". Both titles would fit in well on the shelves for books on Education. But it is possible that the main contents of both would appertain to scientific methodology.

In the spirit of Franz Brentano, let us admit that psychological terms often refer to intellectual contents. Examples of this are certain terms which are used in the traditional textbooks on logic: "concept", judgment", "inference". Everyday conversation contains other examples. If you say that John believes that it is raining, or that he looks at the rain and finds it pleasant, these statements all have something to do with the supposition, or possibility, that it is raining. The exact nature of this involvement does not concern us here. The mentalist and the behaviourist will each have his own explanation, the one simple, the other trickier.

Similarly, expressions like "planning", "motivation", "teaching", "integration", "examination" all have something to do with the logical content of the given subject, involve a relationship to it. The same holds for names of educational objectives like "understanding", "critical outlook", "creative ability". And reference to logical content automatically brings with it a reference to logical and methodological structure.

I have tried to bring out the methodological aspect of "critical ability" in a separate paper (3). In the following pages two other key concepts will be discussed, "motivation" and "depth of study".

1. TECHNOLOGICAL MOTIVATION

Statements about motivation have a psychological flavour. In most cases they explain how an activity is related to aims and needs, to planning and desires. If I say that students of History are motivated by examination awards or by a love-hate relationship to their parents, these are psychological assertions and the reasons given for or against them are psychological. This is quite clear.

The motivation of rational beings has something to do with reasons, however. The sort of reasons one has for pursuing a certain type of study are intimately connected with the subject matter studied. A book about the motivation of an occupation with past events may be concerned with the possible uses of the knowledge of the past. The nature of this type of knowledge immediately becomes relevant.

Interest is then focussed on the technology of historical insight. The question is what you do better after a study of the subject in question. The conclusions will have the form of hypothetical imperatives of the form "If you want to do so and so, you should read history". But technology is always founded in the theoretical structure of science. Indirectly, questions of this structure are raised.

When the reasons for historical study are discussed, psychology and sociology become interesting. Some of the reasons for the study of history are psychological. An important group of such reasons are those which refer to the existence of a psychological motivation. You may for instance say to a son or daughter: The reason for your studying history is that other people are interested in this subject.

This sort of secondary motivation is not uncommon (9). But usually when one explains the reasons for an activity, one tries to specify more fundamental reasons. What makes other people interested in history? One tries to find the primary motivation.

Once again, this may be psychological. But it is not certain. An analysis of the historian's craft leads also in other directions.

It is no easy thing to define and explain the primary reasons for historical study. They are manifold and cannot be reduced to a single formula. The explanation requires a phenomenological and ethical background. One has to understand the way the past enters human life and our basic reasons for doing anything at all. Also, the activities of the historian have to be submitted to a careful analysis.

One of the aspects of historical study is revealed if one starts with an analysis of common sense reasoning. We get along in everyday affairs by fast intuitive applications of vague hunches which are derived from life experience. These hunches have something to do with how often or how seldom things happen. A statistician would say that they are concerned with relativefrequencies. Common sense arguments are in good conformity with the rules of probability theory, which can be regarded as a theory of relative frequencies. (Of course, there is something abortive about these arguments. Premisses are seldom given explicit formulation, classifications remain abscure, decisive numerical quotients do not receive numerical expression.)

An analysis of common sense is valuable, when the use of history is considered. It is easy to see that historical experience constitutes a form of life experience. Frequencies in the life of Louis XVI are not without relevance to ordinary people today. And the explanation of historical incidents has a remarkable structural resemblance to the explanation of everyday affairs. The causes of the French Revolution may have their counterparts when Mr Lewinson's wife, mother, daughter and granddaughter start their own kitchen revolution. Is it farfetched to believe that an historical education constitutes a development of the sort of judgment we require in everyday affairs?

We are here concerned with statements about motivation. The point I want to make is that methodological considerations are sometimes of relevance when one says something about the motivation of a particular form of study. We have seen that an insight into the probabilistic structure of historical argument has this function. Let me add that this sort of insight is not trivial. The matter is certainly open to dispute.

The question remains whether methodological considerations of this type are of educational significance.

Let us form a picture of two undergraduates. One of them is an economist who is supplementing his university studies with a year in History to get a better background, when he starts his work in an office for economic forecasting. He is interested in the prognostic force of material from the present century. To give an example, the development of trade unions will be of importance to him, because of the trend it indicates.

The other undergraduate wants to get a job in a museum. History is for him a subject which leads to the enrichment of everyday life. He believes that modern man cannot live satisfactorily without a feeling of contact with past generations. Eating, working, dressing and sleeping are for him activities which bear the mark of other human beings who have done similar things earlier.

The study of history means different things to these two. Each of them may have found it troublesome to understand his own situation. The two uses are both problematical and the definition and recognition of them may involve struggle. Each of them has tried to achieve insight into his own motivation. There is the pressure of ironical comments from people who deny the prognostic relevance of history or find the idea of an "enrichment of life" ridiculous.

But this sort of definition of a purpose has immediate relevance for the planning of one's studies. In many cases it should have a stimulating effect and lead to a deeper and keener understanding of the material one is confronted with.

2. QUALITATIVE DIFFERENCES IN LEARNING

The analysis of motivation and aims is decisive for the planning of an educational system. Ideas concerning the quality of learning are of similar importance for teaching and for the measurement of results. We certainly have ideals in this sphere. According to common agreement, superficial knowledge is of little value. Even if a student cannot achieve profundity, he should strive for some degree of penetration.

But what does that mean? We speak about the depth of understanding without any clear notion of what we are trying to say. A metaphor is there, and we have the sensual meaning of the words "depth" and "shallowness". But what do we get, if we try to explode the metaphor?

An interesting discussion of "qualitative differences in learning" is to be found in a series of publications by Ference Marton and his co-workers Lars Owe Dahlgren, Lennart Svensson and Roger Säljö. These writers defend a distinction between "deep level processing" and "surface level processing". The use of these two expressions is governed by a battery of different criteria. The precise import of the criteria and their place in the battery is left open (5).

An open approach is useful when a new type of empirical research is initiated. But the central concepts which are employed in this series of studies may be refined in various ways. I first want to introduce a distinction between primary and secondary interests in this connection. This corresponds to the distinction between primary and secondary motivation which was emphasized earlier.

While an undergraduate with the wrong sort of ambition might try to learn his text by heart, a more thoughtful beginner may be looking for the intentions of the writer and proportion his attention to the various aspects of the text accordingly. Or he may have an idea of the tradition he is trying to enter, and look for guidelines which are typical of this tradition. Or, in courageous defence of his own freedom, he may be looking for features which correspond to his conception of his own personality.

Deep level processing might be defined in accordance with such ideals. It is then defined as processing which corresponds to a given set of directives. The directives in question might be those of the textbook, the tradition, the student himself, or some other authority.

Such a definition has its uses. But there is the question of basic criteria. That a textbook writer or you yourself have an interest in this or that has its importance. But why this interest? By a critical analysis one has to get down to more fundamental reasons. What makes people interested?

The interest in adapting oneself to a given set of interests, or a given set of intentions, I call a "secondary interest". The corresponding more basic interests and intentions, I call "primary interests". It is an empirical fact that some interests are of a primary nature. By a deeper analysis one wants to get down to these.

The primary interests which are involved when deep level processing is recommended all belong to a limited group. Some are attitudinal, some methodological.

What does "deep level processing" mean during an education in psychoanalytical therapy? Among other things it means that the student makes himself open to certain decisive life experiences. One cannot understand psychoanalysis without having some knowledge of what anxiety is. An education in this field therefore involves a development towards emotional maturity.

The criteria of more adequate understanding which thus become relevant have something to do with the attitudes of the student. Content is not all-important here.

Other criteria are clearly methodological. What does "deep level processing" mean for a student of Plato's philosophy? For one thing, it means that he has to acquaint himself with arguments about the interpretation of Plato's dialogues. Some of these have to do with the time of composition of the various dialogues. What reasons do we have for regarding the Protagoras as earlier than the Gorgias? This sort of criterion immediately concerns the content of teaching.

We can see that "deep level processing" sometimes means that one understands an argumentative structure. Let me add that a student of Plato's philosophy who tries to get below the surface will learn principles of interpretation which are applicable in other contexts. As soon as he has apprehended the method of dating the dialogues, he has mastered a technique which has many uses. "Deep level processing" has something to do with generalization in this case.

Let us next consider the situation of someone who is trying to learn something essential about the Swedish administration at the end of the last century. Of key importance for such a study is the simple fact that corresponding events today are not open to inspection. Lust for power, obsequiousness, small time corruption, bribery, slackness and stupidity can be discussed in a comparatively open way, when the offenders are all dead. When something underhand happens today, one can be certain that it will not be immediately publicized. An inquiry into conditions eighty years ago receives an extra significance because of the analogies with the present situation.

Such a student should, of course, not close his eyes to these possibilities of analogical inference. Too much innocence would be a sign of superficiality. In more general terms, let us say that practical applications may determine the criteria of deep level processing.

Argumentative structure, generalizations, practical applications, and also other aspects of the structure of a scientific subject, are sometimes relevant when one tries to define suitable criteria of the quality of learning. On other occasions other criteria may be more useful. By the scientific study of educational efficacy, the criteria may be combined in many ways. In history one set will do, in medicine another.

The choice of definition will depend upon educational ideals and the practical context. For anyone who wants to uphold the directives of authority, a reference to the interests of that authority will come in handy. The result will be a definition in which secondary interest is central.

In a profession where the attitudinal component is essential, this should be accorded a key position in the definition. The choice of methodological components, and the importance given to them, will vary in accordance with the theoretical structure of the subject in question.

These variations in the definition of educational depth are of considerable educational significance. By the choice of definition we will experience the force of both psychology and methodology.

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1. Preparation of this paper was supported by a grant from the National Swedish Board of Universities and Colleges. I should like to thank Lars Owe Dahlgren and Ference Marton for valuable information concerning their research.

2. New Delhi 1963, AB Atomenergi SSB - 9

3. What is Critical Ability (forthcoming)

4. This viewpoint has been defended with energy by Rolf Torstendahl in Historia som vetenskap (Natur och kultur, Stockholm 1966, p. 47-48) Similar in kind is the common reference to the entertainment value of history. One has to ask oneself what the motivation for the enjoyment is. What makes history enjoyable?

5. Relevant here are articles by Marton: Scandinavian Journal of Psychology 16(1975)273-279, and 17(1976)41-48, and by Marton and Säljö (in The British Journal of Educational Psychology 46(1976)4-11, 115-127). Of basic importance is Marton's earlier: Inlärning och studiefärdighet, Reports from the Institute of Education at Gothenburgh University, No. 121, 1974, where p. 11-14, 39-49 deserve special attention. A later more popular account is given in Marton, Dahlgren, Svensson and Säljö: Inlärning och omvärldsuppfattning (AWE, Stockholm 1977)

TRANSFORMATIONS

By Pauline Atherton and P.P.M. Meincke

Often acronyms are formed and new words created from old words by combinations such as bit, from binary and digit. These new words take on their own meaning and spawn new words in turn, (e.g., byte for eight bits). Another interesting word game is to find existing words which can be made from combining other words, triggering a whole set of thoughts about the meaning of that word and the words which form its parts. The word transformation can be thought of as a combination of transfer and information, and forms the theme of this essay written to honor a dear friend and colleague, Björn V. Tell.

In ruminating over this word we can cover several areas and topics of interest to him because of his world view of information service. Surely the transfer of information is one of the key components in the development and change (i.e., transformation) of living systems (1) ranging from individuals to societies. The question information professionals must ask is this: has our view of the transfer of information been clear enough to see these transformations?

We raise the question as to whether or not the information systems which have been designed to serve the needs of societies oriented toward large scale technology are appropriate for Development. Will new data bases and new vocabularies be necessary? May it not be necessary to decentralize the data input to provide information from all over the globe rather than just from the High Technology Societies? May it not also be necessary to provide different output than that now found suitable when the receiver is near a well stocked library or report centre? Beside the language barriers to global information systems, there may be design barriers which are not being recognized because our sites and sights have been too myopic.

Have we been caught up in the specific parts of the process, e.g., storage and retrieval, acquisitions, dissemination? We may need to broaden our focus to include the transformations caused by the transfer of information. We know from all the efforts at Unesco, UNIDO, FAO, WHO, IAEA and from regional efforts and national efforts that the transfer of information will play a key role in a new economic order. We should look at information transfer as a component of living systems and not just a system in and of itself.

The transfer of information in the information networks needs to be multi-directional, both at input and output stages and electronic means will need to be developed to support a truly global information network.

The information or data banks would need to be structured to match the queries and requirements which reflect the social concerns and technological developments of a Globe of Villages, not the Aswan dam or the Space Program. The Habitat conference in Vancouver emphasized the need to develop adequate water supplies throughout the world. Much concern has been expressed about the inadequacy of the current food supply to meet the needs of a rapidly growing population. At the same time that there is a need to bring more marginal land into production, the energy shortage makes an extension of the Green Revolution extraordinarily difficult if not impossible. These vital concerns about food, clothing, energy, shelter, tools and related processes will need to be reflected in any new classification schemes and retrieval vocabularies.

The INIS, AGRIS and DEVSIS systems appear to have incorporated many of the above features and there is much we can learn from their structure and operation. But there is a real question as to whether a family of information systems is more appropriate and effective than a more integrated approach insofar as development is concerned. It is interesting to speculate about the possibility of using the theme of appropriate technology as the basis of an integrated information system. The vertical structures of our education, our disciplines, and our government departments actually prevent a horizontal integration of specializations. Is it really necessary to map these vertical structures into the very heart of our information systems and reinforce the barriers between them? Surely the information scientist can accept the challenge of creating a global information system with an integrated deep structure capable of interfacing with vertical units in such a way that the existing power structures would not be threatened. These power structures, (the departments of agriculture, forestry, environment, etc.), could have what appeared to them [illegible] complete control over their "own database" and [illegible] ready access to information belonging to ot[illegible]rtments. In this way all information relevant to th[illegible]blem would be brought to their attention, rega[illegible]ss of the source of input.

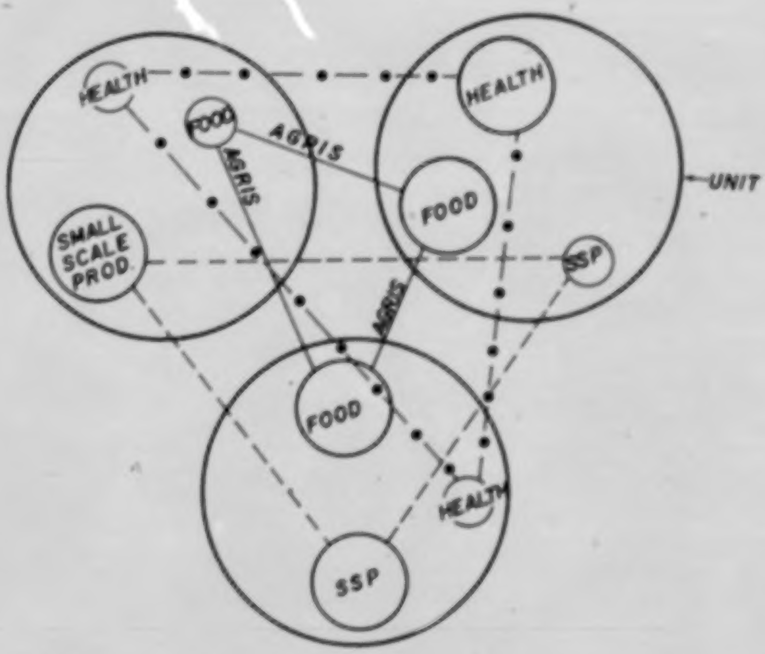

Fig. 1 Units of Living Systems and the Information Transfer Process

A glance at the diagram (Figure 1) makes clear how one's focus on information transfer as a system will distort the view of the role of information in the living systems it serves. Each unit is a living system (a society or a region or a nation) with critical subsystems to sustain its life and growth. Food, health, small scale production, education would be among those critical subsystems, with an infrastructure to maintain balance.

Each critical subsystem within each unit relates to like subsystems in other units through some transfer of information. The food subsystems could benefit from an information service such as AGRIS, which serves to link them and permit a flow of information. The question arises as to whether or not such a service can help to create within these various units or cultures an appropriate information source. A trade or transfer of know how will only occur if the human resources of that living system can receive these information messages and know how, and translate these into tangible products.

A recent UNISIST report on the Independent Appraisal of AGRIS (SC/77/WS/20 - April 1977) faults FAO for not making enough effort to train, guide, and support the exploitations of the AGRIS data base. "As a result, there is a danger that there will be loss of impetus in the development of the programme, and possibly a loss of credibility in the utility of the System" (p. 3).

The success of hydroponic gardening in India, for example, may be far more important to those areas in Africa where aridification is creating severe famine than the irrigation techniques employed in the Imperial Valley of California. The AGRINDEX or AGRICOLA data base may well cover today reports from both India and California, but the method of sorting out and finding the most appropriate reference for the user in Africa may not be a part of the retrieval system. The information service would need to accept data from around the world and also provide a proper connection between the source of appropriate knowledge and the requester, wherever they may be, without creating a transfer or switching problem because all information emanates from a central node. The information from India should have as equal a chance of input as that from California. The requester from India or Tanzania should have as equal an opportunity to find the information items most useful to them as the person in New York, London or Stockholm.

Figure 1 can also be looked at as a globe of villages with loose connections representing not only information services to like subsystems (of the same discipline or problem orientation) but also representing the global communication and transportation systems. Living systems of different sizes are interconnected by the transfer of goods, services, know how, and information.

Given this perspective or world view, the transfers are not seen as the end goal but as an important process for self-sufficiency. Transfers are not seen as transplants from other living systems but as transformations to aid the goals of the other living system.

The perspective from which the transfer of information to support technological development in normally viewed is one in which the technology is being transferred from the highly developed countries to the developing countries. The purpose of this paper was to point out the rapidly growing interest in intermediate or appropriate technology, and to explore the possible impact on information systems as we know them today. There is increasing speculation that the developing countries may move directly into the so-called Post Industrial era. There could well be a totally new approach to technology which could fundamentally influence the structure and the flow of information for development.

The design of an information system is influenced by a number of factors such as the nature of the information stored, the source and receiver of the information, and the available technology, for example computers and micrographics. In the sense used here, information system is taken to include not only the communication and computer technology but also the selection and acquisition policies and procedures for collecting the data to be stored in the system, the structuring and organization of the information, and the searching and retrieval facilities provided.

The controlled vocabularies and access points for retrieval purposes which have grown up over these years tend to reflect the large scale, mass production orientations of the technologies and personnel in these societies, and create an artificial dependency on the part of the developing countries. These are probably not appropriate tools for other living systems. How can we transform these transplants into useful supports for other systems?

Almost all existing information systems and networks are related to and support the developments in highly industrialized societies. The body of knowledge accumulated (on science, technology, medicine or agriculture) in the computer based systems represents the advances made over the past ten to twenty years in these societies. Have we done any tests of the appropriateness of this body of knowledge on a regional or national scale? The report on AGRIS hints at some inadequacies in design of that vital information service for national use.

The transformations we have discussed in this paper point to services which information professionals should begin to plan with a new view of their purpose. For example, one appropriate information service and data base could cover "small scale production technology". If conceived as a service to transform, not transplant appropriate technologies into various "villages" around the globe this transfer of information could provide the means to enhance the quality of life in each village.

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RESEARCH, INTEGRITY AND PRIVACY - NOTES ON A CONCEPTUAL COMPLEX*

By Stephen Schwarz

> *"Some scientists, though by no means all, maintain that the domain of science is universal, that there can be nothing which, as a consequence of some "higher" principle, ought not to be studied. And from this premise the conclusion is usually drawn that any talk of ethical "oughts" which apply to science is inherently subversive and anti-scientific, even anti-intellectual."*
> *(J. Weizenbaum: Computer power and human reason (ref. 86))*

1. AVANT-PROPOS

There are important problems of responsible professional conduct in research which, by their nature, give rise to ambivalence in the current practice of scientists. There is a reasonable wish to conform with conventional standards of conduct. There is also an urge to adhere to a personal "moral point of view". On the other hand the scientific problems posed, and the methods for solving them, may well be in conflict with such standards and views.

This problem is omni-present in research and has certainly been considered frequently and with great insight - so it is hard to add anything of significance which has not been said before in one form or another. Further, the principal question concerns the requirements of a moral attitude and moral action, an area of discourse where there is no lack of paroles and good intentions which would, according to Luther's famous dictum, suffice for paving a major part of the road to hell. Perhaps, though, it is possible for an outsider (from the social science point of view) to engage some measure of the layman's "common sense" in combining a number of seemingly disparate aspects in a partly new way, hopefully leading to a first formulation of some positive suggestion.

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One main point in the following considerations is that problems of integrity are quite generally present in human relations, and that research cannot claim any particular privileges as to waiving its own integrity or trespassing on that of others. In discussions entertained within the research community, precisely such claims are frequently advanced, with direct or indirect reference to the supremacy of the pursuit of knowledge.

The problem hereby gets a deeper significance. It seems basically to derive from the classical thesis of the scientific enterprise as being value-free, and the development of this thesis into a kind of amoral attitude where ultimate utility, framed in general terms of expectations, is taken to justify any means which the scientist would judge to be expedient for the success of his particular research program.

I will here, in the course of the following considerations, argue that such unspecific reference to "the freedom of research and the general social utility of scientific results" cannot be accepted per se as justifying any violation of personal integrity and privacy. Further I will argue that, also from the point of view of the scientific community, it is a matter of both moral and intellectual decency (really concerning the integrity of research itself) to develop and safeguard the protection of integrity and privacy in the conduct of research.

2. THE CONCEPTS OF INTEGRITY AND PRIVACY

In current usage the concepts of "integrity" (here restricted to the area of social relationships) and "privacy" have developed a number of meanings, partly overlapping and partly distinctive. This also implies that the concepts are sometimes interchangeable and sometimes substituted in a way that gives rise to confusion.

To simplify the subsequent discussion, I will here try to isolate a kind of generic definitions. The concept of "privacy" then has to do with the individual person's right and ability to decide for himself what information may be communicated to, from or about him, and the obligation of others to respect such right. The concept of "integrity" has to do with the individual person's right and ability to decide and act autonomously, perhaps in particular in matters of developing and adhering to a personal morality (functioning as a "moral agent"), and the obligation of others to respect this freedom. (Concerning the relation between one's right and others' obligations to respect this right see e.g. ref. 12.) It should be reasonable to speak of P-capacity and I-capacity, and of P-perturbation (-restriction, -intrusion etc.) and I-perturbation (-restriction, -intrusion etc.).

It is, however, noteworthy (and in the nature of the complexity of the problem) that such distinctions are not strictly followed in practice. They are recognized rather clearly in ref. 36. In refs 17, 39 and 48 they are hardly made explicit, and in ref. 24 pertinent matters of the present concern are discussed in a quite different terminology.

Yet, an observation of the meanings, implications and internal relationships of the four concepts seems to be an important prerequisite for a closer analysis, and conversely a failure to make these distinctions may obscure the issues and lead to misunderstandings. A few examples could be taken to illustrate this problem:

Tapping of communication channels by means of diverse electronic devices is an obvious case of P-intrusion, really a special case of surveillance ("monitoring"). Awareness of being subjected to surveillance affects a person's individual freedom of action and thereby leads to I-restrictions with various implications. Different forms of deprivation of liberty render examples of extreme P-restriction. Methods of interrogation that are associated with physical or mental influence are directly I-restrictive, but they may well have as a primary purpose the ensuing degradation of P-defence (and the information revealed can be used for renewed I-intrusions and subsequent P-reduction). The presently popular reference to "manipulation" is often made in cases of I- and P-restricting phenomena, such as advertisements and propagande, which have the evident purpose of exposing the public to impressions and influence without (or even contray to) their expressed desire. If such influence in turn influences individual decisions and conduct, there would be an indirect case of I-restriction. Education, in a very general sense, is also an example of influence which, if for example guided by political ideologies, can be said to be I-restricting - in totalitarian systems frequently with P-restricting elements as effective support. Problems of integrity and privacy associated with collection, processing and use of personal data, particularly in the context of computerized information systems that enable the operator to combine different files and obtain a rapid access to subsets required, have in recent years attracted an increasing attention, also in legislation. Frequently reference is here made to P-intrusion, but information obtained can in turn be used as an instrument for I-intrusion, in terms of decisions that have an impact on the individual or by the mere fact that he becomes aware of personal data being known (e.g. when information is used for blackmailing).

In earlier data handling procedures there was a kind of inherent safeguard of privacy associated with practical difficulties of identifying and accessing relevant information. This barrier has now been eliminated and at the same time it has become more difficult to exercise control over the use of data. Even in representing and communicating purely technical or scientific data one has to be extremely careful so as to avoid any interpretation or application of data that is incompatible with their true significance. It can be a matter of assumptions and other factors which are often subtle and hard to define, and which form a necessary background for a correct perception and understanding of data in their correct context. It can also be a matter of auxiliary information, such as statements about accuracy or completeness, or judgments on relevance of data in a context different from the original one. When quoted without an essential part of such supplementary information - effectively analogous to representing a full dissertation by quoting only a couple of naked tables or diagrams - the message communicated easily becomes unintelligible and in any case unprotected against unwanted or even outright erroneous applications. In the case of data banks carrying personal files such risks are not less disturbing, and they gain a particular weight having direct or indirect consequences for individuals, i.e. they immediately lead to ethical problems.

New means of supervision and control now available or within reach, and difficulties in keeping track of how such means are actually used, have aroused legitimate concern among experts and laymen, although the lay reaction has generally been unexpectedly feeble (as appears e.g. from questionnaire investigations reported in refs 49 and 52). The computer as an instrument of control represents - it is argued - an effect of an unreasonable belief in "instrumental reason" (46), which can be conducive to a society where democratic values imperceptibly but irreversibly disappear.

Some of the examples of I- and P-intrusions are extreme cases, selected to emphasize the associated moral problems. Yet even in situations which are perceived as "normal" in a social context there are always certain limits to acceptability. There is also a continual interaction between factors, characteristic of the particular social system, that tend to reinforce or to restrict integrity and privacy.

It will, however, be obvious from these examples and considerations, that the more general concept of "integrity" is very complex, and that not even the more tangible concept of "privacy", when restricted to applications in physical, psychological and data-technological areas, lends itself to be captured under descriptions like "the right to be left alone - the right most valued by civilized men" (L. Brandeis, quoted in ref. 49, p. 17). I- and P-capacity require a social context and channels of communication governed by socially and individually acceptable rules. Robinson Crusoe's problem is essentially being left alone absolutely: his I- and P-capacity cannot be defined since there do not exist any social restrictions.

From the point of view of psychology or moral philosophy, "integrity" is related to concepts like "personality", "liberty", "confidence" and "respect". These concepts appear to be of fundamental importance in every ethical system based on respect for the value and dignity of each individual. Conclusions reached for solving practical problems can, however, differ considerably, depending on choices of basic values and the attitudes concerning the role and meaning of ethical propositions which characterize different schools of moral philosophy (cf. for example refs 2, 14, 17, 21, 32, 38, 44 and 50).

3. PROFESSIONAL ETHICS

Problems of integrity in the sense of "balancing professional requirements against individual interests" turn up in many cases where professional activities interfere with personal circumstances. Quite generally there is in most professions a need for considering the impact and possible consequences of activities on other persons.

It is, however, hardly possible to separate the control of patterns of conduct which derive from ethical principles and considerations, and control exercised by social and legislative mechanisms. Furthermore, the latter often originate from non-formalized or even non-conceptualized values (the designation of "moral" often - colloquially - meaning no more than such lack of definition of values) on which there is presumably some kind of consensus within a social system. Due to the complexity of the concepts of "integrity" and "privacy" and their role in ethical considerations in general, it is not even possible to divorce the treatment of "integrity" or "privacy" from other components in the study of moral problems.

Attempts at formalizing guidelines of professional conduct have been advanced under the heading of "ethical codes", in most cases obviously modelled in a tradition with roots in a conventional interpretation of the famous Hippocratic oath (ref. 56). They seem to sum up a praxis which only in part belongs to the realm of "ethical" questions in a sense of moral philosophy (see ref. 57-68). Some phrasings in such systems of rules or recommendations are not even specifically relevant for a particular professional fellowship. They are rather concerned with general principles of what might be regarded as elementary decency in professional conduct, sometimes even with a tendency towards the trivial and the rhetoric.

The contents of these codes can vary considerably. Sometimes characteristic decision-making situations are described, where personal, social and professional interests could be in conflict. The idea is then to indicate what kind of considerations should be made. Sometimes general idealized norms are formulated which, if adhered to literally, could on the contrary yield unsolvable conflicts of responsibility. The aim is then probably to maintain a high "standard of excellence" in professional conduct by appealing to a feeling of fellowship, professional pride and duty. Somewhat more profound is a possible effort to create a level of self-discipline by institutionalizing an internal sense of justice. This is based on a conception of the existence or desirability of a far-reaching consensus on values within the profession. It further assumes a belief in the ability, based on professional insights, to analyze and appraise critical situations and to form rational opinions on appropriate ways to handle them (see e.g. ref. 58). In practice, however, neither do such shared values form more than part of an action-guiding moral point of view (see e.g. refs 2 and 38), nor does professional education per se guarantee good judgment in practical cases (- or is there always a "best" rational choice!). There is also an obvious danger of conformism resulting from social pressure, and a danger of professional myopia which precludes proper consideration of environment or of the professional role in a wider context (cf. e.g. ref. 63). In the advancement of formalized codes of professional conduct there may even be an objective to counteract claims of external insight and control in questionable cases, which would not necessarily call for a regular judicial examination or where appropriate legislation in defence of public or individual interest is lacking (cf. e.g. ref. 55).

In most cases, ethical problems in a proper sense are too complex for "ethical codes" of the kind discussed to be instrumental. By the nature of things these codes have to be phrased in much too general terms even to be expected to yield clear-cut guidance. What they offer is rather a statement of social (and even legal) responsibility as it is construed in a particular social setting and they have to leave out (or rather up to the individual/agent) how a personal "moral point of view" should be taken into account - which is after all the essential part of morality (cf. ref. 38). Moral agency is, in a very general sense, an expression of how the agent's personal values and perceptions of a given situation are transformed, by his personality, into decision and action. The individual element in this process in principle cannot be included in or controlled by formalized rules. Therefore, official ethical codes cannot be expected to preclude transgressions of desirable patterns of conduct, in particular if not reinforced by evaluation and social pressure or coercion in one form or another. (On the other hand, an ethical code of conduct, authorized by a strong professional organization, can serve as support in moral conflicts that may come up in professional life, e.g. vis-à-vis employers, customers or the general public, as exemplified by the problem of "whistle blowing").

Much of what is called "professional ethics" is concerned with I-capacity and I-intrusion, related to the professional agent in his multiple roles and loyalties and to those affected by professional performance. When the client's personal situation is involved in the professional activity, his P-capacity will also enter the picture - as e.g. in medical or educational professions. Computer technology has here supplied so revolutionary new possibilities for storage and processing of data that special regulation and control (not least with reference to commercial interests) has become necessary. This is generally done in terms of legislation in areas where standard legal practice and professional ethics have not been effective, comprehensive or reliable enough as instruments of control.

Problems of integrity and privacy which turn up in professional contexts may have political, social, moral and other components. Assessments to be made in treating such problems concern conflicts between the protection of individual I- and P-capacity and reasonable requirements on knowledge and insight, motivated either by public interest or by the conditions for effective professional performance.

Present literature on problems of professional ethics remarkably often originates from persons active within the profession, which means that they are essentially "amateurs" with regard to the area of moral philosophy. When moral philosophers speak on these questions, e.g. as invited extra-professional "experts" in professional conferences, they often present relatively simple discussion notes or essays rather than research results. It is mainly within medical ethics that one finds more systematically pursued studies. This is apparently related to the circumstance that, in medical ethics, it is particularly easy to find practical problems that can be isolated and subjected to pedagogical simplification, and which therefore can serve as characteristic examples in discussions about fundamental ethical questions. Even well documented interest in medical ethics found in moral philosophy is therefore only secondary. One might perhaps justifiably say that there is essentially a lack of permanent connection and interaction between present research in moral philosophy, and applied ethical problems of professional life.

4. ETHICS OF RESEARCH

It might be possible to regard research as a special kind of professional activity. Although research may take on very different appearances depending on area, context and objectives etc., there are some basic common features, foremost that new knowledge should be a direct result of the activity. It is therfore not surprising that specific ethical codes have evolved for a number of research areas, partly in order to define (or delimit) the subsystem of research, partly in order to define and regulate the responsibility of scientists and of "research" vis-à-vis the world around. The general features that characterize the phrasing of such systems of rules are recognized also in the case of research as a profession. There is here perhaps also an ambition to safeguard against the risk of erosion in the concept of "research" through uncontrolled growth, and against abuse of the reputation of the research system through activities which do not conform to certain basic requirements of quality or excellence regarding the output of "information" and "knowledge". Such systems of rules often emphasize a well-articulated (and rigid) view of knowledge and the growth of knowledge (e.g. in terms of objectivity, value-freedom, emotional neutrality, rationality, cumulativity etc.) Frequently a more or less idealized view of the role of research in society is indistinctly perceptible. The problems of integrity (and of privacy) get pointed by the requirement of "freedom of inquiry", stated in general terms of universal applicability, but rarely combined with explicit clauses concerning the responsibilities associed with research.

In the extensive literature that has grown up on problems of "research and integrity" this requirement of freedom plays a fundamental role. It is therefore important in the present context to scrutinize a number of components in the concept of "research", not altogether uncontroversial, which are connected to the meaning that can be allocated to the concept of "freedom of research" and cognates. This analysis can be pursued from perspectives of the history of ideas, the sociology of science and the philosophy of science.

An analysis along those lines is interesting since it can clarify the impact of the concept of "scientific freedom" on university politics and on the development of research institutions. The analysis should inter alia explain the role of the concept in the formation of a popular image of scientific research, and the meaning this same concept has been given by different agents in critical situations where the scientific ethos has been challenged. (The nuclear weapons and nuclear energy debates and the question of recombinant DNA-research are cases in point.) Here it is not possible to give more than a sketchy and modest indication of the kind of ideas and relationships that might contribute relevant arguments towards a deeper understanding of the phenomenon.

In the history of ideas, the conception of the "freedom of research" or "freedom of inquiry" as a fundamental prerequisite for organized scientific endeavour appears to bear some relationship to the growth of the philosophical faculty in German universities in the nineteenth century (cf. ref. 4). It is here important to emphasize the term "organized", which is an idea of relatively recent origin, since we are here dealing with conditions of research (and impact of science on society) very different from the situation experienced by, for example, Galileo. In the academic tradition of nineteenth century Central European universities, the concept of "freedom of research" acquired a particular socio-political significance. It became associated with a characteristically academic demarcation with respect to social problems, a separation of "pure research" from "applied research and technology" and a closed system of accredited areas of inquiry, academic disciplines. Official norms developed in this environment, formulated for example in a famous essay by Max Weber, seem to have been of central importance to an influential functionalistic branch of "sociology of science", originally advanced by R. Merton (cf. e.g. refs 28 and 42), and more generally in the formation of the image of research held within the research community itself. The term "official norms" is here used intentionally, since they could apparently be reconciled with a strict paternalistic internal organization and other features which we would today perceive as directly incompatible with open-minded attitude in matters intellectual and moral.

This view of research and of ethical norms for the scientific system has also met with strong criticism from a wider sociological perspective, and it has been shown to be in poor agreement with prominent features in the present systems and processes of research (refs 3 and 29). Similar shifts can be observed by an analysis of the moral philosophy of problems of responsibility inherent in the growing social significance of research and research processes (ref. 43). Part of the picture is also the expansion of the scientific system, the mass of more or less well-founded "scientific" information, and the continued erasion of the boundaries between fundamental research and applied R & D. Finally, the philosophy of science has moved markedly away from claims (for science) of objective, general and definitive results and cumulative growth of knowledge, to more modest ambitions, e.g. in terms of "critical rationalism", and a stronger feedback between theory and observation in the development of what should rather be understood as provisional insights and theoretical constructs (e.g. refs 25 and 41).

The development just indicated, and its implications, have been observed systematically only during the past fifteen years in moral philosophy (cf. ref. 19) and in the sociology of science (cf. e.g. refs 7, 8, 9). The shift in attitudes and interpretations actually includes the problems of "integrity, privacy and research" as a natural though not easily separable component in an integrative assessment of the nature and pursuit of knowledge, and the role of research in society (cf. e.g. refs 11, 16 and 35). The purpose of making a digression, albeit simplified and incomplete, into this development is of course to present a perspective for arguments which correlate a general concept of "freedom of inquiry" with judgments on matters of integrity and privacy encountered in the process of research. It is certainly a trivial statement that the said concept has different meanings depending on where, by whom and in which context it is referred to. The important observation to make is, however, that of the many possibilities the exact meaning to be conveyed in a particular instance is rarely made clear explicitly, with ambiguities as a necessary consequence. Historically speaking, the term "freedom of research (inquiry)" has apparently been effective in certain circumstances, even if used in a very unspecific way, to accentuate a position in university politics. Yet a debate on this level, which should certainly be a continual phenomenon, has no immediate impact on the directions and programs of current research. On the level of particular projects the concept of "freedom of inquiry" must necessarily be defined accurately (and operationally) and in the research process has to be associated with a well-defined concept of "responsibility of the scientist" which takes particulars of the research situation into account. One of the main problems is to delimit the system where relevant features are to be considered, and to define adequate principles for assessment of conflicting interests. Arguments based on claims for "freedom of inquiry" in a discussion of conditions for creative performance will be convincing only if such considerations and principles are stated explicitly. Otherwise these arguments will easily get the appearance of claims for academic privileges belonging to an epoch passed long ago.

It is possible to discern different kinds of problems of integrity and privacy associated with research. The first main group - "problems of the first kind" - originate in the scientist's various roles (qua scientist, scientific advisor, teacher, colleague, member of society and private person) and also from the possible conflict between role-performance and performance as "moral agent". Further, this kind of problems is inherent in the responsibility of institutions and governing bodies for the selection, funding, management and evaluation of research programs. We are here in the first place considering responsibility for the "standard of excellence" of achievements, for effective communication and for sufficiently deep concern with potential undesired consequences of the research work or (possible) results, risks of abuse and needs of control mechanisms. Frequently these problems are related to what was earlier called I-capacity (e.g. the ability to resist coercion to suppress inconvenient results, or the ability to pass unbiassed judgments - particularly when exercising decisive influence through position or as an expert). It is here often a question of civic courage and sense of responsibility in a professional role. There is of course also the other side, causing I-intrusion by exerting formal or informal pressure (consciously or unconsciously) in order to prevent an agent from exercising his full I-capacity.

The other main group - "problems of the second kind" - present themselves only in certain areas of research where it is necessary, due to the nature of the research program, to engage human participants at different stages of the project. The term "participants" should here be understood in a wide sense, meaning persons who contribute documentary information, data or other materials related to their personal condition or circumstances, whether or not they take part in the research process directly. It is easy to understand why it is exactly in areas where such information supply is needed that research programs already on the planning stage have to be subjected to particularly careful assessment with respect to purpose, method and a number of criteria of quality. The obvious purpose of such assessment is that intrusions into the private life of individuals affected by the study can be held at a minimum and that in any sense "unnecessary" nuisance can be ruled out. (It should here be observed that I- or P-problems "of the first kind" are by no means less important from an intellectual or moral point of view, or with respect to the role of research in an open society.)

Three basic conditions are frequently proposed for the ethical acceptability of studies with human participants (in the above sense). These are "voluntary informed consent", "confidential treatment of primary information and of results retraceable to a person", and "the right for the participant to withdraw on his own request at any time".

Not unexpectedly, it turns out that there is often in practice a clear conflict between these I- and P-safeguarding prerequisites and the conditions under which research work has to be performed. The clause on confidentiality gives rise to both technical difficulties and dilemmas with respect to professional ethics. Essentially one has to solve the problems of storage, retrieval and processing of information under satisfactory precautions (cf. refs 39, 49 and 53). It is, however, obvious that data security to a large extent is a matter of resources (financial as well as availability of systems personnel and time). It may well appear more adequate to the investigator to invest his limited funds in accomplishments that more directly advance his own work, than to create guarantees against hypothetical disturbances of integrity or privacy. From the individual "human participant's" point of view there is a kind of balancing factor, viz. the I-capacity and competence of the scientists involved which, jointly with control mechanisms operative in the scientific and the social & legal systems, should ensure necessary protection against indiscretions and more far-reaching transgressions.

Voluntary informed consent is often problematic in principle (as is the right to withdraw). The nature of the study may be incompatible with the participant being entirely (or even partly) informed about what he is really participating in. It may, to begin with, be difficult to convey a comprehensive understanding about the study and its fundamental implications (which need not even be clearly perceived by the project manager until the end results are available – or not even then). The participator's conduct may be distorted by his knowledge or awareness of the observer's hypotheses or the theoretical basis of the study. Voluntariness may even be difficult to define in a clearcut way. Already the conditions defining the working situation (the scientist's authority and initiative, a general respect for research etc.) may put the participant in an awkward position, effectively akin to a direct influence through persuasion. In some studies based on extensive personal data files it may for practical reasons be impossible to solicit consent. We are here concerned with both I- and P-disturbance, possibly sequentially in several steps by subsequent restriction of the participant's I- and P-capacity (refs 26, 37, 45).

For a detailed analysis of specific "problems of the second kind" in research it is often helpful to start by making a number of distinctions. It may for example be possible to distinguish different levels of operation, characterized by

(a) observation of artificially stimulated phenomena (e.g. physical, psychical or social experiments under controlled conditions)

(b) observation of naturally occurring phenomena (e.g. sociological, socio-anthropological or linguistic field studies)

(c) recording of (statistical or other) information that requires active co-operation by a selected group of participants (e.g. questionnaire studies)

(d) retrieval, processing and recombination of data and other information compiled and stored on an earlier occasion (e.g. from archives or files established in a context and with a purpose different from that of the present study).

In group (a) it is possible to speak about "individuals of experimentation", in group (b) perhaps of "participants", in group (c) often about "respondents" or "informants" and in group (d) rather about "quasi-respondents" or "co-respondents", i.e. persons related to existing material. This descriptive terminology indicates why, within different areas of research, the seriousness of problems of integrity and privacy are perceived very differently and that licences of various kinds would seem to be motivated.

It lies close at hand to ask whether P-disturbances are in principle less serious than I-disturbances. If this were the case, it would be possible to conclude that projects involving work with "respondents" generally speaking could be performed under less rigorous control than projects involving work with "individuals of experimentation". Due to the relations and feedback between I-and P-disturbances mentioned earlier, which can be more or less tangible in a particular situation, this general hypothesis cannot be correct in a general sense. Legal and moral rules that have evolved or been created to protect integrity and privacy therefore cannot reasonably be made to depend on, for example, the formal classification of a project in terms of the groups (a) - (d). The application of these rules must rather depend on identification and evaluation of I- or P-disturbances and their possible implications for the individuals concerned. It is also clear that such judgments cannot always be made in an uncontroversial and unique way.

It is rather to be expected that, in each area, there will grow an accepted practice or set of conventions, depending on the intellectual and moral "climate" and the mechanisms for management and control that are established or evolve. For example, it is readily possible to perform gigantic social experiments of the kind represented by an educational reform (and more generally by implictions of socio-political decisions) without explicit mentioning or particular consideration of I- and P-problems in the decision-making process. On the other hand, general regulations may result in rather restrictive attitudes to what might appear as comparatively weak P- (or I-) disturbances in the data processing area. (Ironically, such restrictivity may result in prohibitive restrictions for some studies that even might, at least according to the project proposals, aim at reducing uncertainties in social experimentation through political decisions.)

It is now evident why arguments referring in an unspecific way to the "freedom of inquiry", to the public utility of research or to expected social innovations and improved "quality of life" do not always carry a conclusive weight. They may even be an "excuse of the impenitent" to justify research with I- and P-disturbing components. In other cases there may be propensity to underestimate the significance of a (potential) disturbance in phrases like "one should not be so sensitive (touchy)" (26). Considerable effort has, however, been spent in creating control mechanisms (refs 22, 65 and more generally 39, 48, 49 and 53). One difficulty is that, ultimately, there will always be a question of balancing the importance of a research program against legitimate or fair consideration of the individual where general rules, instructions or conventions do not give clearcut guidance.

There is now some consensus that such judgment cannot be left entirely up to the scientist's discretion, but even on the level of professional peers there are obvious dangers of overestimating the value of a research program and the I-capacity of research staff, and to underestimate the import of possible I- and P-disturbance.

As a consequence of such difficulties, control proceeds in a system of complementary bodies for evaluation with different areas of responsibility and range of authority. There is in some cases a prescribed examination according to existing law. There may be special committees within the scientific community or the particular research area for scrutiny of the ethical and qualitative aspects of research proposals or on-going research. There is also a growing general interest in the use of research funds and the relations of science to society, which results in press debates and in representatives for the public interest on various boards, committees and advisory groups.

Legislation cannot be expected to allow the scientific enterprise particular licence or privileges, not even with reference to promised progress of general utility for society (cf. ref. 37 p. 1195). On the other hand it is often possible in scientific work to adopt methods and to supervise and control processes so that relaxed conditions for dealing with emerging problems of integrity and privacy can be acceptable. In this way conflicting requirements for protection of the individual and for pursuit of the research program may in most cases be reconciled.

5. SOME HALF-BAKED IDEAS

From arguments of the kind advanced here (and which are not particularly novel) it is possible to draw a number of conclusions and to make certain recommendations. These should certainly be further investigated and supported before a more concise and operational formulation can be given.

1. Ethical considerations (by definition) become actualized in all situations where one's actions influence, or might influence, the condition of others (cf. e. g. refs 14 and 17).

To the scientist (qua scientist) this is the case in his relations to colleagues, eventual "individuals of experimentation" and other persons that participate or in other ways get involved in the research process or affected by its results. In such ethically oriented considerations, supported by a (possibly idealized) self-assessment of the importance of one's own work, it is easy to let personal and professional interests become predominant over what might appear to be extra-professional compliance. On the other hand, in a given practical situation it is not at all easy to see how those general ethical principles one would accept without hesitation when stated in a general way, like e.g. Kant's categorical imperative or even a reasonably phrased utilitarian basic principle, should be translated into operational action-guiding rules. A survey of principal decision-making problems with ethical components within different research areas (as e.g. in ref. 65) might therefore be a first step towards a significant achievement. The survey should then be followed up by a larger project, contracted to some highly productive institution active in applied problems of moral philosophy, and with an aim to investigate what kinds of "prudential discurse" would arise in such decision-making situations in consequence with current schools of ethics. Such studies would hopefully yield some guidance, in the different disciplines, as to how the requirements of an independent, reflected and consistent stance in moral matters - a "moral point of view" (cf. ref. 2) - might be formed, and also explain or indicate the basis of incompatibilities in different attitudes.

II. Ethical questions can be regarded as a special class within a wider range of decision-making problems. In research a number of fundamental conditions, properly characterized as matters of responsibility, have to be fulfilled before there is any reason to consider the ethical problems in a more narrow sense. The reason is that already on the more general level it is possible to eliminate many research proposals as inadequate. The assessment of the scientific quality of a project is an example. Characteristic features to be evaluated are in the first place the content of scientific ideas, originality (possibly allowing for "creative redundancy"), and relations to the international research front within the area of research and development. Further factors of importance are the relevance, validity and supportive power of theories and methods and earlier results, and the competence of research management and staff to be involved. The primary purpose of such evaluation is of course rational use of resources. When ethical problems enter the picture it is, however, particularly urgent to reject disturbances of integrity and privacy judged to be "unnecessary" since they would arise from meaningless or outright unsund projects (cf. e.g. ref. 37).

Some examination along these lines takes place in the handling of research proposals by many funding agencies. Hopefully, only proposals satisfying certain primary quality norms that might reasonably be set up as minimum requirements for justifying any kind of disturbance of integrity and privacy will be passed on. (The standardization of such norms is part of the role of "codes of conduct", ethical committees etc.) Yet many more or less important studies performed on behalf of agencies or organizations within the public and private sectors (often - euphemistically - presented as "research programs") and many studies on a smaller scale (e.g. diploma work of various kinds, "thesis" work on the BA-level etc.) probably do not in all respects fulfil such minimum requirements.

For continual development of principles for assessment of research proposals it might be valuable to carry out a study on a number of terminated projects with obvious I- and/or P-disturbing components. The idea would be to look at the scientific level of the projects and the quality, usefulness and wider implications of the results, also to be compared to the original proposal. Possibly it will turn out that in many cases it would have been possible already at a very initial stage to conclude that the project should be regarded as inadequately designed from a scientific point of view (although care must be taken to avoid after-rationalization). In any case it would be possible from a comparative evaluation of this kind to get a basis for discussions on how more efficient advance judgments might be made without thereby inhibiting innovative and unconventional ideas.

III. When such qualitative criteria concerning responsibility in research are reasonably well satisfied, there still remains a stance to be taken on the particularly ethical problems involved. As argued before, semi-formal norms laid down in "ethical codes" only give general (abstract) phrasings of an official or conventional morality. The objective for ethical committees or ethically oriented "science courts" is mainly to exercise some measure of control of how generally (overtly or covertly) accepted principles are applied in practice. In practical considerations arguments in defence of I- and/or P-disturbances brought about by research have to deal with several difficulties. First the value of the outcome of research is hard to assess beforehand - it may even become evident only in the long run. Second, the significance, range and implications of eventual I- and/or P-disturbances are hard to estimate from merely a research proposal. In an operational morality governed only by "ethical codes" it may therefore lie close at hand for the scientist-agent to pass a judgment to the effect that his problem is unique and should be regarded as an exceptional case, and that orthodox rules and catechism (e.g. the very ambitious code of ref. 65) should not apply (see e.g. ref. 66). The difference between adapting one's actions in accordance with an "official" morality codified in pre-formulated rules, instead of acting in accordance with a personal "moral point of view" becomes evident exactly in a tendency for arguing in terms of "rules" and "exceptions" instead of "right" and "wrong" (see e.g. ref. 38). There is also an obvious danger that those responsible for research policy and research funding operate - in the interest of science - with a relatively high threshold for triggering warning signals concerning "unethical research activities". The very limited number of cases that are put under scrutiny (see e.g. ref. 22, supplement), the very large number of cases that should in principle be candidates for discussion (cf. refs 24, 37, 45 and the background material for ref. 65) and the nature of professional criticism advanced counter the principles of evaluation (e.g. ref. 66) seem to give some support to this suspicion.

It is easy to conceive of a natural extension of the protection of integrity and privacy, which should also be in the interest of research. It is probably current practice in many areas, and to varying degree, that research proposals have to be accompanied by an analysis of expected I- and/or P-disturbances, their significance and range, and also by arguments in defence of the suggested procedure. However, it would be readily possible to make further demands for evaluations to be presented in the final research report. One is concerned with the question whether the original analysis and defence of I- and P-disturbances would still be valid or fair. Another question is whether I- and P-safeguarding commitments implied in the conditions of the research grant were honoured in a satisfactory way. As an immediate effect of such requirements, research groups would be compelled to think deeper, more imaginatively and more constructively about I- and P-problems associated with their projects. Further, such analyses would yield an empirical basis directly useful in continual evolution of norms (and attitudes to norms) for more satisfactory future conditions of research procedures.

IV. One question of supreme importance in evaluating the scientific quality of a project and in arguing about consequential I- and/or P-disturbances concerns the general competence of the research group and its (documented) ability to deal with I- and P-problems. When an experienced and reputable scientist is actually directing the work himself, the assignment of responsibilities will appear to be clear in principle, but even then the practical responsibility may be shared in such a way that critical factors may go out of control. For example, general directives may be issued for regulation and control of which disturbances are to be regarded as acceptable, while the factual operative procedure is delegated to the judgment of co-workers without reinsurance with the project director (by definition of the concept of "delegation"). Very commonly, inexperienced research students are obliged to work more or less on their own, possibly supported by occasional instruction (which only in favourable cases can be fully comprehended). It is therefore of primary importance in scientific training for research areas where I- and P-problems are frequently occurring, that the student's sensitivity to such problems is actively developed. Three comments may be briefly outlined in this context:

IVa. The "handbook" or analytical review of general ethical problems in research with area-specific applications and with didactic discussions of hypothetical situations (suggested in Point I above) can be immediately used to develop an understanding of the need for a measure of "prudential discourse" in quotidian research activity. To this end a particular emphasis should be given to a basic distinction referred to earlier. This is the difference between an "official" morality (that can be accounted for in terms of "value consensus", "ethical codes" etc.), and an internally consistent personal morality, a "moral point of view", on which the agent has ultimately to rely in all decisions where other people's interests have to be balanced against subjective assessment of professional interests and personal ambitions.

IVb. Another important problem related to research training derives from the fact that it is not possible to develop insights and to gain experiences merely by studying the literature of research reports, which amounts to taking the role of an external observer instead of being involved in active participation. There is practically always a need for an element of "learning by doing". In particular in research activities which involve "individuals of experimentation", it should be rather uncontroversial to suggest as a universal principle that measures be taken to prevent any P- and/or I-disturbances that follow from insufficient knowledge on the part of the investigator and a too narrow view of his own performance. One way to tackle this problem is to use different forms of computer models, including features of simulation techniques, as educational tools. Constructing models for didactic purposes gives a good training in carrying out a systems analysis pertinent to the research problem in identifying important factors and suppressing less important ones, in viewing the problem in a perspective of relevant theories etc. The simulation model can subsequently be used to generate realistic data sets for studies on various partial problems. A fundamental advantage of this approach is that it is possible to create research conditions with variable, yet completely controlled, conditions. This means that the results of data processing and analysis can be verified and the student's performance evaluated. It is frequently possible to use such methods heuristically also in research proper, as exemplified by techniques of the Monte-Carlo kind. One purpose may be to find a more appropriate formulation and understanding of the problem itself. Another may be to study the significance of different factors that contribute to uncertainties in quantitative results, which may considerably influence decisions on method and strategy for actual field studies. Finally, simulation techniques can often be successfully used for a first test of the implications of theoretical models, and to make predictions on the basis of theories that have been previously tested by empirical studies. Computer technology can in this way often be utilized in order to avoid "unnecessary" I- and/or P-disturbances, and also to reduce the need for empirical data in research programs that are judged to be sufficiently important to justify a certain measure of such disturbances being involved.

IVc. By default of useful theoretical foundations it is not uncommon in empirical studies to apply methods that should rather carry the epithet "brute force", although they would be presented euphemistically as "pragmatic". The basic idea is the somewhat naive expectation that, by first collecting a mass of data that describe some reality in some sense, it will subsequently be possible to find regularities, correlations, causal connections etc. In cases where such data compilation has I- and/or P-disturbing side-effects it would seem advisable to apply particularly rigorous precautions. It would be reasonable to require preparatory studies, impeccably conceived and carried out, that would demonstrate which sources of error might be expected to dominate and which dimensions a full-scale investigation would have to take in order to yield statistically relevant results. These preparatory studies would also unmask more or less sophisticated phrasings of the all too common simplistic justification that "some day it might turn out to be convenient having certain classes of data available". In some areas such preparatory studies are probably performed as part of the research management procedure, e.g. in testing new pharmaceutical products. But there are ample indications that extensive programs in behavioural and social sciences have been launched without satisfactory ground-work of this kind. It might not even be too daring a conjecture that pre-scientific exercises on the undergraduate level, which are often of limited format but extremely numerous, and in particular much of the massive data collection performed by agencies in the public sector, cause quantitatively immense disturbances that might to a large extent be avoided by more conscientious planning and control.

x x x

These are a few notes on an important conceptual complex, with an emphasis on problems of integrity and privacy in research. Possibly are my misgivings unwarranted, and possibly are adequate control mechanisms already operational. Possibly am I therefore throughout these deliberations "breaking up open doors", and instead it may be the case that "tous les événements sont enchaînés dans le meilleur des mondes possibles". But what if instead Dr. Strangelove has put on Dr. Pangloss' wig?

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THE HIPPOCRATIC OATH
(Transl. by L. Edelstein, ref. 56)

I swear by Apollo Physician and Asclepius and Hygieia and Panaceia and all the gods and goddesses, making them my witnesses, that I will fulfil according to my ability and judgment this oath and this covenant:

To hold him who has taught me this art as equal to my parents and to live my life in partnership with him, and if he is in need of money to give him a share of mine, and to regard his offspring as equal to my brothers in male lineage and to teach them this art—if they desire to learn it—without fee and covenant; to give a share of precepts and oral instruction and all the other learning to my sons and to the sons of him who has instructed me and to pupils who have signed the covenant and have taken an oath according to the medical law, but to no one else.

I will apply dietetic measures for the benefit of the sick according to my ability and judgment; I will keep them from harm and injustice.

I will neither give a deadly drug to anybody if asked for it, nor will I make a suggestion to this effect. Similarly I will not give to a woman an abortive remedy. In purity and holiness I will guard my life and my art.

I will not use the knife, not even on sufferers from stone, but will withdraw in favor of such men as are engaged in this work.

Whatever houses I may visit, I will come for the benefit of the sick, remaining free of all intentional injustice, of all mischief and in particular of sexual relations with both female and male persons, be they free or slaves.

What I may see or hear in the course of the treatment or even outside of the treatment in regard to the life of men, which on no account one must spread abroad, I will keep to myself holding such things shameful to be spoken about.

If I fulfil this oath and do not violate it, may it be granted to me to enjoy life and art, being honored with fame among all men for all time to come; if I transgress it and swear falsely, may the opposite of all this be my lot.

DECLARATION OF HAWAII
(World Psychiatric Association, ref. 67)

Ever since the dawn of culture ethics has been an essential part of the healing art. Conflicting loyalties for physicians in contemporary society, the delicate nature of the therapist–patient relationship, and the possibility of abuses of psychiatric concepts, knowledge and technology in actions contrary to the laws of humanity, all make high ethical standards more necessary than ever for those practising the art and science of psychiatry.

As a practitioner of medicine and a member of society, the psychiatrist has to consider the ethical implications specific to psychiatry as well as the ethical demands on all physicians and the societal duties of every man and woman.

A keen conscience and personal judgement is essential for ethical behaviour. Nevertheless, to clarify the profession's ethical implications and to guide individual psychiatrists and help form their consciences, written rules are needed.

Therefore, the General Assembly of the WORLD PSYCHIATRIC ASSOCIATION has laid down the following ethical guidelines for psychiatrists all over the world.

1. The aim of psychiatry is to promote health and personal autonomy and growth. To the best of his or her ability, consistent with accepted scientific and ethical principles, the psychiatrist shall serve the best interests of the patient and be also concerned for the common good and a just allocation of health resources.

To fulfill these aims requires continous research and continual education of health care personnel, patients and the public.

2. Every patient must be offered the best therapy available and be treated with the solicitude and respect due to the dignity of all human beings and to their autonomy over their own lives and health.

The psychiatrist is responsible for treatment given by the staff members and owes them qualified supervision and education. Whenever there is a need, or whenever a reasonable request is forthcoming from the patient, the psychiatrist should seek the help or the opinion of a more experienced colleague.

3. A therapeutic relationship between patient and psychiatrist is founded on mutual agreement. It requires trust, confidentiality, openness, co-operation and mutual responsibility. Such a relationship may not be possible to establish with some severely ill patients. In that case, as in the treatment of children, contact should be established with a person close to the patient and acceptable for him or her.

If and when a relationship is established for purposes other than therapeutic, such as in forensic psychiatry, its nature must be thoroughly explained to the person concerned.

4. The psychiatrist should inform the patient of the nature of the condition, of the proposed diagnostic and therapeutic procedures, including possible alternatives, and of the prognosis. This information must be offered in a considerate way and the patient be given the opportunity to choose between appropriate and available methods.

5. No procedure must be performed or treatment given against or independent of a patient's own will, unless the patient lacks capacity to express his or her own wishes or, owing to psychiatric illness, cannot see what is in his or her best interest or, for the same reason, is a severe threat to others.

In these cases compulsory treatment may or should be given, provided that it is done in the patient's best interests and over a reasonable period of time, a retroactive informed consent can be presumed and, whenever possible, consent has been obtained from someone close to the patient.

6. As soon as the above conditions for compulsory treatment no longer apply the patient must be released, unless he or she voluntarily consents to further treatment.

Whenever there is compulsory treatment or detention there must be an independent and neutral body of appeal for regular inquiry into these cases. Every patient must be informed of its existence and be permitted to appeal to it, personally or through a representative, without interference by the hospital staff or by anyone else.

7. The psychiatrist must never use the possibilities of the profession for maltreatment of individuals or groups, and should be concerned never to let inappropriate personal desires, feelings or prejudices interfere with the treatment.

The psychiatrist must not participate in compulsory psychiatric treatment in the absence of psychiatric illness. If the patient or some third party demands actions contrary to scientific or ethical principles the psychiatrist must refuse to co-operate. When, for any reason, either the wishes or the best interests of the patient cannot be promoted he or she must be so informed.

8. Whatever the psychiatrist has been told by the patient, or has noted during examination or treatment, must be kept confidential unless the patient releases the psychiatrist from professional secrecy, or else vital common values or the patient's best interests make disclosure imperative. In these cases, however, the patient must be immediately informed of the breach of secrecy.

9. To increase and propagate psychiatric knowledge and skill requires participation of the patients. Informed consent must, however, be obtained before presenting a patient to a class and, if possible, also when a case history is published, and all reasonable measures be taken to preserve the anonymity and to safeguard the personal reputation of the subject.

In clinical research, as in therapy, every subject must be offered the best available treatment. His or her participation must be voluntary, after full information has been given of the aims, procedures, risks and inconveniences of the project, and there must always be a reasonable relationship between calculated risks or inconveniences and the benefit of the study.

For children and other patients who cannot themselves give informed consent this should be obtained from someone close to them.

10. Every patient or research subject is free to withdraw for any reason at any time from any voluntary treatment and from any teaching or research programme in which he or she participates. This withdrawal, as well as any refusal to enter a programme, must never influence the psychiatrist's efforts to help the patient or subject.

The psychiatrist should stop all therapeutic, teaching or research programmes that may evolve contrary to the principles of this Declaration.

ETHICAL PRINCIPLES IN THE CONDUCT OF RESEARCH WITH HUMAN PARTICIPANTS

(American Psychological Association, ref. 65)

The decision to undertake research should rest upon a considered judgment by the individual psychologist about how best to contribute to psychological science and to human welfare. The responsible psychologist weighs alternative directions in which personal energies and resources might be invested. Having made the decision to conduct research, psychologists must carry out their investigations with respect for the people who participate and with concern for their dignity and welfare. The Principles that follow make explicit the investigator's ethical responsibilities toward participants over the course of research, from the initial decision to pursue a study to the steps necessary to protect the confidentiality of research data. These Principles should be interpreted in terms of the context provided in the complete document offered as a supplement to these Principles.

1. In planning a study the investigator has the personal responsibility to make a careful evaluation of its ethical acceptability, taking into account these Principles for research with human beings. To the extent that this appraisal, weighing scientific and humane values, suggests a deviation from any Principle, the investigator incurs an increasingly serious obligation to seek ethical advice and to observe more stringent safeguards to protect the rights of the human research participant.

2. Responsibility for the establishment and maintenance of acceptable ethical practice in research always remains with the individual investigator. The investigator is also responsible for the ethical treatment of research participants by collaborators, assistants, students, and employees, all of whom, however, incur parallel obligations.

3. Ethical practice requires the investigator to inform the participant of all features of the research that reasonably might be expected to influence willingness to participate and to explain all other aspects of the research about which the participant inquires. Failure to make full disclosure gives added emphasis to the investigator's responsibility to protect the welfare and dignity of the research participant.

4. Openness and honesty are essential characteristics of the relationship between investigator and research participant. When the methodological requirements of a study necessitate concealment or deception, the investigator is required to ensure the participant's understanding of the reasons for this action and to restore the quality of the relationship with the investigator.

5. Ethical research practice requires the investigator to respect the individual's freedom to decline to participate in research or to discontinue participation at any time. The obligation to protect this freedom requires special vigilance when the investigator is in a position of power over the participant. The decision to limit this freedom increases the investigator's responsibility to protect the participant's dignity and welfare.

6. Ethically acceptable research begins with the establishment of a clear and fair agreement between the investigator and the research participant that clarifies the responsibilities of each. The investigator has the obligation to honor all promises and commitments included in that agreement.

7. The ethical investigator protects participants from physical and mental discomfort, harm, and danger. If the risk of such consequences exists, the investigator is required to inform the participant of that fact, secure consent before proceeding, and take all possible measures to minimize distress. A research procedure may not be used if it is likely to cause serious and lasting harm to participants.

8. After the data are collected, ethical practice requires the investigator to provide the participant with a full clarification of the nature of the study and to remove any misconceptions that may have arisen. Where scientific or humane values justify delaying or withholding information, the investigator acquires a special responsibility to assure that there are no damaging consequences for the participant.

9. Where research procedures may result in undesirable consequences for the participant, the investigator has the responsibility to detect and remove or correct these consequences, including, where relevant, long-term aftereffects.

10. Information obtained about the research participants during the course of an investigation is confidential. When the possibility exists that others may obtain access to such information, ethical research practice requires that this possibility, together with the plans for protecting confidentiality, be explained to the participants as a part of the procedure for obtaining informed consent.

the chemist's creed

AS A CHEMIST, I HAVE A RESPONSIBILITY:

to the public

to propagate a true understanding of chemical science, avoiding premature, false, or exaggerated statements, to discourage enterprises or practices inimical to the public interest or welfare, and to share with other citizens a responsibility for the right and beneficent use of scientific discoveries.

to my science

to search for its truths by use of the scientific method, and to enrich it by my own contributions for the good of humanity.

to my profession

to uphold its dignity as a foremost branch of learning and practice, to exchange ideas and information through its societies and publications, to give generous recognition to the work of others, and to refrain from undue advertising.

to my employer

to serve him undividedly and zealously in mutual interest, guarding his concerns and dealing with them as I would my own.

to myself

to maintain my professional integrity as an individual, to strive to keep abreast of my profession, to hold the highest ideals of personal honor, and to live an active, well-rounded, and useful life.

to my employees

to treat them as associates, being ever mindful of their physical and mental well-being, giving them encouragement in their work, as much freedom for personal development as is consistent with the proper conduct of work, and compensating them fairly, both financially and by acknowledgment of their scientific contributions.

to my students and associates

to be a fellow learner with them, to strive for clarity and directness of approach, to exhibit patience and encouragement, and to lose no opportunity for stimulating them to carry on the great tradition.

to my clients

to be a faithful and incorruptible agent, respecting confidence, advising honesty, and charging fairly.

Approved by the Council of the American Chemical Society,
September 14, 1965

Engineers' Creed

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I pledge—:

To give the utmost of performance;

To participate in none but honest enterprise;

To live and work according to the laws of man and the highest standards of professional conduct;

To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge.

Adopted by
National Society of Professional Engineers
June, 1954

NSPE Publication No. 1104

Code of Ethics

For Engineers

Preamble

The Engineer, to uphold and advance the honor and dignity of the engineering profession and in keeping with high standards of ethical conduct:

● *Will be honest and impartial, and will serve with devotion his employer, his clients, and the public;*

● *Will strive to increase the competence and prestige of the engineering profession;*

● *Will use his knowledge and skill for the advancement of human welfare.*

Section 1—The Engineer will be guided in all his professional relations by the highest standards of integrity, and will act in professional matters for each client or employer as a faithful agent or trustee.

a. He will be realistic and honest in all estimates, reports, statements, and testimony.

b. He will admit and accept his own errors when proven wrong and refrain from distorting or altering the facts in an attempt to justify his decision.

c. He will advise his client or employer when he believes a project will not be successful.

d. He will not accept outside employment to the detriment of his regular work or interest, or without the consent of his employer.

e. He will not attempt to attract an engineer from another employer by false or misleading pretenses.

f. He will not actively participate in strikes, picket lines, or other collective coercive action.

g. He will avoid any act tending to promote his own interest at the expense of the dignity and integrity of the profession.

Section 2—The Engineer will have proper regard for the safety, health, and welfare of the public in the performance of his professional duties. If his engineering judgment is overruled by nontechnical authority, he will clearly point out the consequences. He will notify the proper authority of any observed conditions which endanger public safety and health.

a. He will regard his duty to the public welfare as paramount.

b. He shall seek opportunities to be of constructive service in civic affairs and work for the advancement of the safety, health and well-being of his community.

c. He will not complete, sign, or seal plans and/or specifications that are not of a design safe to the public health and welfare and in conformity with accepted engineering standards. If the client or employer insists on such unprofessional conduct, he shall notify the proper authorities and withdraw from further service on the project.

Section 3—The Engineer will avoid all conduct or practice likely to discredit or unfavorably reflect upon the dignity or honor of the profession.

a. The Engineer shall not advertise his professional services but may utilize the following means of identification:

(1) Professional cards and listings in recognized and dignified publications, provided they are consistent in size and are in a section of the publication regularly devoted to such professional cards and listings. The information displayed must be restricted to firm name, address, telephone number, appropriate symbol, names of principal participants and the fields of practice in which the firm is qualified.

(2) Signs on equipment, offices and at the site of projects for which he renders services, limited to firm name, address, telephone number and type of services, as appropriate.

(3) Brochures, business cards, letterheads and other factual representations of experience, facilities, personnel and capacity to render service, providing the same are not misleading relative to the extent of participation in the projects cited, and provided the same are not indiscriminately distributed.

(4) Listings in the classified section of telephone directories, limited to name, address, telephone number and specialties in which the firm is qualified.

b. The Engineer may advertise for recruitment of personnel in appropriate publications or by special distribution. The information presented must be displayed in a dignified manner, restricted to firm name, address, telephone number, appropriate symbol, names of principal participants, the fields of practice in which the firm is qualified and factual descriptions of positions available, qualifications required and benefits available.

c. The Engineer may prepare articles for the lay or technical press which are factual, dignified and free from ostentation or laudatory implications. Such articles shall not imply other than his direct participation in the work described unless credit is given to others for their share of the work.

d. The Engineer may extend permission for his name to be used in commercial advertisements, such as may be published by manufacturers, contractors, material suppliers, etc., only by means of a modest dignified notation acknowledging his participation and the scope thereof in the project or product described. Such permission shall not include public endorsement of proprietary products.

e. The Engineer will not allow himself to be listed for employment using exaggerated statements of his qualifications.

Section 4—The Engineer will endeavor to extend public knowledge and appreciation of engineering and its achievements and to protect the engineering profession from misrepresentation and misunderstanding.

a. He shall not issue statements, criticisms, or arguments on matters connected with public policy which are inspired or paid for by private interests, unless he indicates on whose behalf he is making the statement.

Section 5—The Engineer will express an opinion of an engineering subject only when founded on adequate knowledge and honest conviction.

a. The Engineer will insist on the use of facts in reference to an engineering project in a group discussion, public forum or publication of articles.

Section 6—The Engineer will undertake engineering assignments for which he will be responsible only when qualified by training or experience; and he will engage, or advise engaging, experts and specialists whenever the client's or employer's interests are best served by such service.

Section 7—The Engineer will not disclose confidential information concerning the business affairs or technical processes of any present or former client or employer without his consent.

a. While in the employ of others, he will not enter promotional efforts or negotiations for work or make arrangements for other employment as a principal or to practice in connection with a specific project for which he has gained particular and specialized knowledge without the consent of all interested parties.

Section 8—The Engineer will endeavor to avoid a conflict of interest with his employer or client, but when unavoidable, the Engineer shall fully disclose the circumstances to his employer or client.

a. The Engineer will inform his client or employer of any business connections, interests, or circumstances which may be deemed as influencing his judgment or the quality of his services to his client or employer.

b. When in public service as a member, advisor, or employee of a governmental body or department, an Engineer shall not participate in considerations or actions with respect to services provided by him or his organization in private engineering practice.

c. An Engineer shall not solicit or accept an engineering contract from a governmental body on which a principal or officer of his organization serves as a member.

Section 9—The Engineer will uphold the principle of appropriate and adequate compensation for those engaged in engineering work.

a. He will not undertake or agree to perform any engineering service on a free basis, except for civic, charitable, religious, or eleemosynary nonprofit organizations when the professional services are advisory in nature.

b. He will not undertake work at a fee or salary below the accepted standards of the profession in the area.

c. He will not accept remuneration from either an employee or employment agency for giving employment.

d. When hiring other engineers, he shall offer a salary according to the engineer's qualifications and the recognized standards in the particular geographical area.

e. If, in sales employ, he will not offer, or give engineering consultation, or designs or advice other than specifically applying to the equipment being sold.

Section 10—The Engineer will not accept compensation, financial or otherwise, from more than one interested party for the same service, or for services pertaining to the same work, unless there is full disclosure to and consent of all interested parties.

a. He will not accept financial or other considerations, including free engineering designs, from material or equipment suppliers for specifying their product.

b. He will not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with his client or employer in connection with work for which he is responsible.

Section 11—The Engineer will not compete unfairly with another engineer by attempting to obtain employment or advancement or professional engagements by competitive bidding, by taking advantage of a salaried position, by criticizing other engineers, or by other improper or questionable methods.

a. The Engineer will not attempt to supplant another engineer in a particular employment after becoming aware that definite steps have been taken toward the other's employment.

b. He will not pay, or offer to pay, either directly or indirectly, any commission, political contribution, or a gift, or other consideration in order to secure work, exclusive of securing salaried positions through employment agencies.

c. He shall not solicit or submit engineering proposals on the basis of competitive bidding. Competitive bidding for professional engineering services is defined as the formal or informal submission, or receipt, of verbal or written estimates of cost or proposals in terms of dollars, man days of work required, percentage of construction cost, or any other measure of compensation whereby the prospective client may compare engineering services on a price basis prior to the time that one engineer, or one engineering organization, has been selected for negotiations. The disclosure of recommended fee schedules prepared by various engineering societies is not considered to constitute competitive bidding. An Engineer requested to submit a fee proposal or bid prior to the selection of an engineer or firm subject to the negotiation of a satisfactory contract, shall attempt to have the procedure changed to conform to ethical practices, but if not successful he shall withdraw from consideration for the proposed work. These principles shall be applied by the Engineer in obtaining the services of other professionals.

d. An Engineer shall not request, propose, or accept a professional commission on a contingent basis under circumstances in which his professional judgment may be compromised, or when a contingency provision is used as a device for promoting or securing a professional commission.

e. While in a salaried position, he will accept part-time engineering work only at a salary or fee not less than that recognized as standard in the area.

f. An Engineer will not use equipment, supplies, laboratory, or office facilities of his employer to carry on outside private practice without consent.

Section 12—The Engineer will not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice or employment of another engineer, nor will he indiscriminately criticize another engineer's work. If he believes that another engineer is guilty of unethical or illegal practice, he shall present such information to the proper authority for action.

a. An Engineer in private practice will not review the work of another engineer for the same client, except with the knowledge of such engineer, or unless the connection of such engineer with the work has been terminated.

b. An Engineer in governmental, industrial or educational employ is entitled to review and evaluate the work of other engineers when so required by his employment duties.

c. An Engineer in sales or industrial employ is entitled to make engineering comparisons of his products with products by other suppliers.

Section 13—The Engineer will not associate with or allow the use of his name by an enterprise of questionable character, nor will he become professionally associated with engineers who do not conform to ethical practices, or with persons not legally qualified to render the professional services for which the association is intended.

a. He will conform with registration laws in his practice of engineering.

b. He will not use association with a nonengineer, a corporation, or partnership as a "cloak" for unethical acts, but must accept personal responsibility for his professional acts.

Section 14—The Engineer will give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.

a. Whenever possible he will name the person or persons who may be individually responsible for designs, inventions, writings, or other accomplishments.

b. When an Engineer uses designs supplied to him by a client, the designs remain the property of the client and should not be duplicated by the Engineer for others without express permission.

c. Before undertaking work for others in connection with which he may make improvements, plans, designs, inventions, or other records which may justify copyrights or patents, the Engineer should enter into a positive agreement regarding the ownership.

d. Designs, data, records, and notes made by an engineer and referring exclusively to his employer's work are his employer's property.

Section 15—The Engineer will cooperate in extending the effectiveness of the profession by interchanging information and experience with other engineers and students, and will endeavor to provide opportunity for the professional development and advancement of engineers under his supervision.

a. He will encourage his engineering employees' efforts to improve their education.

b. He will encourage engineering employees to attend and present papers at professional and technical society meetings.

c. He will urge his engineering employees to become registered at the earliest possible date.

d. He will assign a professional engineer duties of a nature to utilize his full training and experience, insofar as possible, and delegate lesser functions to subprofessionals or to technicians.

e. He will provide a prospective engineering employee with complete information on working conditions and his proposed status of employment, and after employment will keep him informed of any changes in them.

Note: In regard to the question of application of the Code to corporations vis-a-vis real persons, business form or type should not negate nor influence conformance of individuals to the Code. The Code deals with professional services, which services must be performed by real persons. Real persons in turn establish and implement policies within business structures. The Code is clearly written to apply to the Engineer and it is incumbent on a member of NSPE to endeavor to live up to its provisions. This applies to all pertinent sections of the Code.

TAPPI

CODE OF ETHICS

The Technical Association of the Pulp and Paper Industry expects that each member shall be guided in his conduct by the following:

1. He shall guard and uphold the high standard of honor for which the association stands, by fidelity to the interests of his employers, or clients and by a fine spirit of courtesy and friendliness in his intercourse with all members of the association.
2. In all his relations he shall be guided by the highest principles of honor and thus maintain the dignity and higher reputation of the association.
3. He shall not use any unfair, improper, or questionable method in securing employment.
4. He shall, when he is an executive and an employer of members of the association, act fairly and with consideration in his relations with member employees.
5. He shall carefully avoid any interference with the business of a fellow member by resorting to any member's [illegible] to the professional services for the divulging of technical secrets of processes known to such [illegible] employer.
6. He shall cooperate in improving the application of technical information as connected with the pulp and paper industry, and will also, so far as seems wise, exchange general information and experience with fellow members, and will further make more valuable the association by contributing technical papers where such information does not conflict with the interests or interests of his employer or client.
7. He shall be frank in the expression of opinion regarding work requested of him by clients or employers where such work seems to present improbabilities of successful results and they advise before undertaking the work.
8. He shall be diligent in exposing and opposing such errors and frauds as his experience and knowledge enable him to recognize.
9. He shall not use undignified, sensational, or misleading language or advertising that is likely to discredit him or his membership in the association.
10. He shall not issue and shall discourage his associates from issuing any publicity featuring statements made in papers or articles published by him through the medium of the association, which will exaggerate or otherwise improperly represent the facts as stated in such articles.
11. He shall interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill, and training for the use and benefit of mankind.
12. In all cases not covered by the above it is suggested that a close observance of the Golden Rule may be regarded as a proper guide of conduct.

INFORMATION ET DEVELOPPEMENT

Par Pierre Piganiol

Les systèmes d'information et de documentation ont fait des progrès considérables tant du fait des possibilités offertes par les calculatrices modernes que grâce à l'introduction des notions de réseaux ou de banques de données. Une quantité prodigieuse de réflexions a permis de dégager les principes de base de l'automatisation des tâches documentaires, mais aussi de jeter les fondements d'une coopération internationale à l'échelle mondiale. Qu'il me soit permis ici de saluer l'action de Björn Tell en ce domaine et de lui exprimer la reconnaissance de ceux pour qui la qualité de l'information apparaît comme la condition du progrès technique et social.

Lorsque dans la chaîne d'une processus industriel - un atelier chimique par exemple - apparaît pour un de ses éléments une innovation remarquable et efficace, on découvre que des éléments voisins sont inadaptés ou insuffisants et qu'ils constituent désormais les facteurs limitant les performances de l'ensemble. Il en est de même dans les chaînes documentaires. Les immenses progrès accomplis dans le domaine du traitement de l'information font apparaître les insuffisances des processus situés en amont et en aval de ce traitement.

Certes tout n'est pas parfait dans le traitement actuel de l'information, mais on peut affirmer que les études théoriques récentes aussi bien que les coopérations de caractère politique permettront d'améliorer la rapidité, le coût et la qualité des services. C'est donc rendre un hommage à tous les artisans des progrès réalisés et en cours que de souligner les points d'imperfection qui apparaissent du fait même du succès de leurs efforts.

1. LA CHAINE DOCUMENTAIRE ET LE DEVELOPPEMENT

En schématisant on peut dire que l'ensemble des connaissances et des expériences humaines constitue un "stock" S au sens que l'on donne à une collection d'objets rassemblés dans un magasin.

Un tel stock se gère par élimination des éléments périmés, introduction d'éléments neufs, restructuration du mode de rangement. Cette "gestion de la connaissance" est une des grandes tâches des civilisations. Elle s'accomplit par des voies subtiles et complexes et ne semble pas avoir attiré l'attention des chercheurs en sciences humaines. Il y a pourtant là un beau champ de réflexion et d'études, qui ne peut être réduit au domaine de l'histoire des sciences. Mais nous ne faisons que signaler son importance et le laissons en dehors de notre étude.

Pour être "traités", c'est-à-dire sélectionnés et retrouvés, les éléments de ce stock doivent être associés à des informations convenables. En réalité, les connaissances elles-mêmes ne sont pas "traitables". Ce que l'on peut espérer traiter c'est l'ensemble des informations que l'on fait correspondre à l'ensemble des connaissances. Certains pensent que l'on pourra un jour traiter directement la connaissance au moyen de l'informatique: ceci supposerait une formalisation de la science qui est encore loin de notre atteinte (les axes d'une telle recherche ont été indiqués par René Leclercq dans ses études sur la logique du plausible). La correspondance entre le contenu de nos connaissances et les informations que nous y attachons mériterait en tous cas une longue étude que nous laisserons également de côté. Nous arrivons donc à un ensemble I d'informations correspondant à l'ensemble S à l'aide d'un certain processus (marqué a sur le schéma) dont il n'est pas sans intérêt de signaler qu'il est à double sens (d'où la double flèche du schéma) car la création de l'ensemble I est un des éléments parmi beaucoup d'autres qui provoquent la restructuration de S.

Schéma simplifié des relations entre connaissance et développement

$$S \underset{(\alpha)}{\Longleftrightarrow} I \underset{(\beta)}{\Longrightarrow} I(j) \underset{(\gamma)}{\Longrightarrow}$$

Ensemble des connaissances	Ensemble des informations associées	Sous ensemble des informations pertinentes

$$\overset{(\gamma)}{\Longrightarrow} S(j) \overset{(\delta)}{\Longrightarrow} A(j) \overset{(\varepsilon)}{\Longleftrightarrow} A$$

Sous ensemble des connaissances utiles	Décision d'action particulière	Plan global de développement

Soit maintenant un acteur particulier du développement d'un pays. Tout ce qui le concerne sera affecté de l'indice j. Il a besoin dans son domaine d'un ensemble de connaissances S(j), sous-ensemble de S qu'il espère obtenir à travers I(j), sous-ensemble de I contenant les informations qui lui sont utiles.

Le processus d'extraction de I(j) de I est le traitement de l'information, celui qui précisément a fait tant de progrès récemment. Le processus γ qui permet de passer de I(j) à S(j) est celui de la constitution de connaissances à partir d'informations. C'est celui qui retiendra plus longuement notre attention.

Mais la chaîne n'est pas finie : il faut passer de S(j) à A(j), c'est-à-dire de la connaissance à l'action, et cette action même devra s'insérer dans l'ensemble A des actions de développement, dans leur "plan", sans que ce mot soit à prendre au sens restreint que lui donne la politique ou l'administration. (Il y a bien entendu réaction mutuelle des diverses actions possibles et de leur ensemble).

Ce processus de passage à l'action, noté δ sur le schéma est très complexe: nous en dirons quelques mots plus loin.

2. LA RESTITUTION DE CONNAISSANCES A PARTIR D'INFORMATIONS

C'est actuellement le facteur limitant de l'efficacité de la chaîne complète. Nous l'examinerons en tentant de dégager deux séries de mesures, les unes pour les pays en développement, les autres pour les pays industrialisés, qui devraient apporter une amélioration à une situation qui est beaucoup plus grave qu'on le pense communément.

Admettons que l'intéressé ait obtenu le signalement de tous le documents pertinents. Il faut qu'il en assimile le contenu, en déduise les solutions possibles pour son problème, les évalue et fasse un choix. Ceci suppose:

- de sérieuses connaissances de base,
- un savoir faire pratique qui seul permet de se représenter les difficultés possibles et la valeur des solutions,
- des informations complémentaires que la documentation prend rarement en compte,
- une réflexion sur l'adaptation des techniques envisagées au context local physique et humain,
- éventuellement un pouvoir d'innovation dans les domaines techniques et sociaux pour réaliser cette adaptation.

Admettons que les connaissances de base existent. Il faut d'ailleurs souligner ici l'ampleur de l'effort d'éducation supérieure accompli par les pays en voie de développement. Mais il faut se demander aussi si les compétences ainsi créées sont effectivement utilisables dans leurs propres domaines.

Nous serons par contre très sceptiques sur le second point: les pays en développement ont accentué un défaut de la plupart des enseignements du monde industrialisé, la séparation du savoir et du savoir faire. Dans nos pays existent des correctifs nombreux ne serait-ce que l'efficacité formatrice de la vie professionnelle et la présence de nombreux "relais" tels que les ingénieurs d'arts et métiers, les techniciens supérieurs et la maîtrise, qui, eux, savent faire et ont été entraînés à cela. Ces correctifs sont absents des pays en voie de développement, dotés souvent de grandes universités et rarement d'écoles d'ingénieurs, les unes et les autres presque toujours privées de moyens suffisants de travaux pratiques.

D'ailleurs, même si ceux-ci étaient excellents, ils ne pourraient donner l'aptitude au jugement que seule donne une véritable recherche. Le manque de centres techniques apparaît ainsi comme le facteur le plus important du risque d'échec du développement. Il en résulte également l'impossibilité d'adapter les techniques aux conditions locales. Et l'expérience confirme ce pessimisme: on observe presque toujours qu'il n'y a pas transfert de technologie, mais simple placage d'un outil qui reste étranger.

De ces considérations - trop brutalement schématiques en raison de la brièveté de cet article et qu'il faudrait nuancer - résultent toute une série d'actions à entreprendre.

Dans les pays en développement il importe d'orienter la formation supérieure dans un sens qui équilibre mieux la théorie et la pratique, et de développer des centres techniques couvrant les domaines du développement envisagé. Il importe également d'y créer des centres nationaux de documentation qui sauraient acquérir dans chaque cas les informations sélectionnées en provenance de partout dans le monde et les transformer en une note de synthèse ordonnée et hiérarchisée. Alors s'établirait un dialogue fructueux entre les documentalistes et les ingénieurs responsables. D'autres questions complémentaires seraient posées à la documentation mondiale, à la lumière des difficultés rencontrées au cours d'expérimentations simplifiées qui seules donnent le "jugement". La description de ces centres nationaux de documentation et de ces centres techniques d'expérimentation sortirait du cadre de cet article. Disons simplement qu'ils ne doivent pas être copiés sur les organismes similaires des pays industrialisés; les stratégies à suivre sont différentes et un bon dialogue Nord-Sud permettrait de les dégager. En particulier, la stratégie à utiliser pour que les essais techniques servent d'abord à comprendre et assimiler, ensuite à juger et adapter, est loin d'être évidente, surtout si l'on veut réduire les dépenses au minimum utile, sans gaspillage de trop rares ressources.

3. L'AIDE DES PAYS INDUSTRIALISES

Nous venons de voir que trois conditions sont nécessaires pour qu'on pays puisse acquérir les connaissances indispensables dans un domaine déterminé de son développement:

a) disposer d'hommes ayant une bonne formation théorique et pratique de base,

b) être capable de leur fournir une bonne documentation sélectionnée, ordonnée, évaluée,

c) être capable de mesurer par des expériences bien conduites les véritables difficultés qui risquent d'apparaître, et de définir les modifications à apporter aux technologies importées pour qu'elles soient assimilables et s'intégrent dans le contexte économique et social local.

En aucun cas les pays industrialisés ne peuvent se substituer aux autres pour accomplir cet effort. Bien que l'on parle souvent du "transfert de connaissances", il faut rappeler que celles-ci ne sont en rien comparables à des liquides que l'on transvase d'un tonneau dans un autre.

Apporter une aide limitée est cependant possible.

1) En ce qui concerne la formation le plus utile serait de décrocher les pays en voie de développement des modèles classiques de l'enseignement qu'ils utilisent. Ces modèles sont inséparables d'innombrables éléments sociaux: structures des professions et des carrières, organisation de la formation pratique dans l'entreprise, mécanismes de compétition exigeant de gros efforts individuels, par example.

Faire connaître ces éléments - après les avoir analysés, ce qui est rarement fait - et susciter une réflexion plus profonde sur les liens entre enseignement et société est une tâche indispensable. Il faut provoquer des innovations, au sein des enseignements comme au sein des sociétés en développement pour que l'ensemble des mécanismes d'acquisition et de la mise en pratique des connaissances fonctionne harmonieusement et efficacement. Mais il faut prendre en compte la totalité de ces mécanismes, qu'ils fassent partie ou non de ce que l'on est convenu d'appeler "l'Enseignement".

2) En ce qui concerne l'accès à la documentation mondiale, les pays industrialisés ont fait dans leur propre intérêt un énorme effort, totalement bénéfique pour les pays en développement, à condition toutefois que ces derniers ne croient pas que l'accès à l'information est équivalent à l'accès à la connaissance et qu'ils n'oublient pas que la structuration de la documentation ne se fait pas uniquement à l'aide de critères techniques - qui sont à peu de choses près les mêmes pour tous les pays - mais aussi à l'aide de critères économiques, sociaux et politiques qui varient beaucoup d'un pays à un autre.

3) Quant à l'effort qui doit permettre d'évaluer, d'adapter et d'innover, il ne peut être accompli que par les intéressés eux-mêmes. Mais faute de pouvoir les aider en pensant à leur place, nous pouvons faciliter leur effort en pensant avec eux.

Ce qui précède ne concerne que l'assimilation des connaissances et des technologies, base d'un développement indépendant. Nous ne refusons pas pour autant la simple implantation de techniques étrangères avec importation du matériel, mais aussi des hommes qui savent l'utiliser. Cette voie de développement sera souvent - et pour encore longtemps - utile; mais j'insiste encore une fois: ce n'est pas un "transfert" de technologie, mais un placage. Cela peut donner lieu par la suite à un véritable transfert mais à condition d'employer des méthodes adéquates.

4. L'ENTRAIDE REGIONALE

Le très lourd effort à accomplir pour assurer un développement industriel peut être allégé par la coopération de plusieurs pays à structures économiques et politiques semblables. Ils peuvent en effet mettre en commun les outils techniques d'enseignement, de recherches et de documentation, dégager en commun les critères de choix, entreprendre en commun les études d'adaptation ou d'innovations nécessaires. Et ceci même si les outils industriels qu'ils construiront par la suite doivent être en concurrence. D'ailleurs ces coopérations régionales sont indispensables pour effacer un jour les effets nocifs de frontières absurdes héritées du colonialisme. L'effort technique a ceci de commun avec l'effort de production et de vente qu'il ne peut se développer efficacement que dans une communauté humaine dont la population dépasse une "masse critique" rarement atteinte (les pays de quelques millions d'habitants abondent en Afrique!).

5. L'ENTRAIDE INTERNATIONALE

Elle présente des formes multiples qui sont bien connues. L'ONUDI est le cas le plus achevé d'une coopération internationale à l'échelle planétaire. L'action de l'OCDE est celle d'un véritable Club des pays industrialisés, qui mettent en commun leurs compétences et leurs volontés d'aide. La CEE est un groupe de pays industriels liés institutionnellement; son aide s'apparente de près aux aides bilatérales, etc. . .

Mais nous voudrions insister sur le rôle possible de deux types d'organisations, l'un récent, l'autre encore à naître.

Le premier est parfaitement représenté par le Club de Dakar. Organisation informelle, c'est un point de rencontre d'hommes de bonne volonté appartenant autant aux pays en développement qu'aux pays industrialisés. N'agissant qu'à titre personnel et dans un cadre très libre, ces personnalités peuvent étudier objectivement et sans passions tous les problèmes posés par le développement et l'instauration d'un nouvel ordre mondial. Il semble que la transformation des informations en connaissances ordonnées, critiques et opérationnelles pourrait entrer dans le champ des études d'un tel Club.

L'autre type d'organisation ne figure qu'à l'état de projet d'études, précisément aussi au sein du Blub de Dakar. Il s'agit de transformer l'épargne des pays industrialisés en capitaux de risques pour les pays en développement par le biais de sociétés multinationales dont la mission serait d'acquérir et de louer des installations industrielles, à des sociétés locales de production qui, elles, pourraient ne faire appel qu'au potentiel d'épargne - souvent réduit - de leur pays en développement. De telles sociétés de crédit-bail seraient par nature obligées de préparer, en liaison avec leurs clients les choix, les adaptations et les innovations technologiques souhaitables. Elles seraient donc le lieu privilégié de rassemblement de l'information, de son classement, et de sa transformation en synthèses critiques étroitement liées au processus de prise de décision technico-économique.

La grande interrogation à laquelle il faudra répondre dans les prochaines années est, dans le domaine de l'information, la suivante: par qui, où et comment l'information se transformera-t-elle en connaissances, et quel usage saura-t-on faire de ces dernières?

ON ALERTING PEOPLE TO ENVIRONMENTAL HAZARDS: A NEW ROLE FOR INFORMATION PROFESSIONALS

By Manfred Kochen

In the world of tomorrow, there will almost certainly be a greater demand for those services which in effect can ensure for vast numbers of people the health and well-being to which they will feel entitled. Major advances in well-being are most likely to come from large-scale education of the public, i.e., alerting them to health hazards and helping them to change to lifestyles that avoid such hazards. Control of environmental hazards is a new area where public libraries could contribute greatly, provided they are willing to reshape their services. That task will almost certainly require newer forms of organizational services which would be integrated into multinational networks, the judicious use of information technologies, and educating a new kind of information professional. It will also require new criteria for evaluating the resulting systems.

Björn Tell (1965) was one of the first to stress that criteria for evaluating information systems should be established for the total system, i.e., the entire process, rather than for any one of its components, such as cataloging or classifying. He also understood that such criteria, whether developed for inventory, communication or information systems, are expressed in terms of time and costs. If the concept of cost is interpreted sufficiently broadly, it subsumes time-based criteria by means of wage rates, and includes costs not just to the system's owner or manager but to the clients and to the community. Although Tell has made many contributions toward reducing costs by improving the efficiency and effectiveness of data base searching, his original goal of developing evaluation criteria for general purpose, total information systems has been very elusive. One way to approach this goal may be to focus attention on information systems aimed at helping people and communities cope with important problems, and evaluating these systems in their performance of that special purpose.

I. ENVIRONMENTAL HAZARDS

When some people learn through the mass media or from friends that certain substances in food might cause cancer, they turn to libraries to obtain more complete and reliable information. No hard data indicate what fraction of the population does this, nor how well libraries are meeting the need for this kind of information. But there are opportunities to improve this interaction.

A recent newspaper story tells of one Michigan medical researcher who practices what he preaches (Myers, 1977). His family does not buy Michigan meat because of the presence of PBB (polybrominated biphenyls) that entered the food chain when a fire retardant was accidentally mixed into cattle feed grains (Corbett, 1977). They avoid eating liver or kidney because these are the body's chief detoxification organs: Concentrations of chemicals are highest there. They avoid butter, ice cream, and cheeses made from Michigan milk because PBB tends to concentrate in the fatty part of milk. They avoid commercial drinks with artificial coloring, such as Red Dye #2 and #40. They refrain from using styrofoam cups because this causes the body to absorb small traces of styrene. They do not buy TRIS-treated clothes, microwave ovens, bug sprays, or lawn weed killers, do not expose themselves to routine X-rays and abstain from cigarettes and alcohol.

Other newspaper stories alert the public to the information that up to 3 million pairs of sleepwear have been treated with Fyrol, another fire retardant that was used after TRIS was banned, and it, too, is a suspected carcinogen. One of the televised news programs in Ann Arbor presented a brief story on the risks of consuming fish with high PCB (polychlorinated biphenyl) content that are found in the Great Lakes. It also implicated widely used hair dyes as containing suspected carcinogens. The story pointed out that even though Michigan or the U.S. government might regulate the distribution of potentially hazardous items, that is not the case for all other countries, and the U.S. imports items suspected of a high PCB content.

Stories of this kind, presented effectively over the mass media, begin to worry a large number of people. Very little is known about the level of general public knowledge regarding toxic substances. (The level of public knowledge about nutrition appears to be very low according to opinions of public health experts.) A small fraction of the population is constantly watching for bad things to avoid and these people will immediately abstain from items that are merely mentioned in a questionable context. Another small fraction consists of confirmed food faddists who go to extremes; at one extreme, there are people who will not feed their children milk because they believe it causes homosexuality; at the other, there are people who give them 2000-3000 mg. of calcium daily in the form of powdered milk. The number of people who will consume even items clearly marked DEADLY with skull and crossbones, in the belief that if it is sold it must be all right, is also a significant though small fraction! (private communication from Dr. S. Garn, 10-18-77). What little is known about consumer behavior suggests that it is quite inconsistent and uninformed.

In the area of tobacco consumption the effect of information about the health hazards of tobacco on consumer behavior has been thoroughly investigated. After the U.S. Surgeon General stated in 1964 that cigarette smoking can be hazardous to health, there was a temporary drop in sales followed by a rise above pre-alarm levels. Demand for cigarettes in the U.S. is projected to rise steadily at 2-4% per year, mostly for low tar products. In the U.K., daily consumption of tar cigarettes per adult rose by 13% from 1950 (when the relation between cigarette smoking and disease was first recognized) to 1965; after that it fell so that in 1977 it is 27% below 1950 levels. The corresponding figures for nicotine cigarettes are 18% and 13% (Doll, 1977; Lee, 1976). The American Cancer Society, which seems to have failed in its campaign to educate the public to the health hazards of smoking, is believed by some to be engaged now in an effort to make smoking socially unacceptable.

The effect on the producer of disseminating information about the potential hazard of a product is much more pronounced. A large number of products have been taken off the market, even in the absence of any evidence, simply to avoid tarnishing the producer's image. Individual firms in threatened industries tend to adapt to changing consumer tastes. The industry as a whole often tends to see issues as a political adversary process - e.g. "anti-smoking forces" vs. the tobacco industry - rather than a health issue to be enlightened by impartial scientific methods.

When scientific findings are introduced into the debate, they are likely to be used to further each adversary's position rather than to arrive at an objective by satisfactory compromise. It is known, for example, that increasing the number of outlets for the sale of alcoholic drinks and lowering the legal alcohol-purchasing age increases the level of consumption (Popham, et al., 1976; Bruun, et al., 1975). But income and urbanism are more closely related to alcohol consumption than even availability (Smart, 1977). Thus, alcohol producers would do well in regions where the percentage of population in urban areas is high such as the District of Columbia. Regulators and those concerned with public safety and health would thus be expected to anticipate and oppose attempts by the alcohol industry to move into those regions.

Regulatory agencies have been slow to respond, waiting for more conclusive evidence. The United States Food and Drug Administration, in permitting products to be marketed, seems to have favored the criterion of proof that products are not hazardous over proof that they are safe. It may, however, be developing more interest in evaluative research. Some of the bibliometric techniques of information science may prove to be useful, if used in combination with other ways of judging importance of publications. The public has come to expect results from science with more certainty than science is able to deliver. This results in some loss of public trust in science. Enactment of sound legislation lags behind the pressure on regulatory agencies in one product area after another.

The need for many regulatory agencies to make decisions by consensus does not always inject the most advanced level of knowledge into the decision-making process. "Turf-problems", i.e., resolution of conflicts over jurisdictional authority, resources, and vital interests must be resolved before substantive issues can be attended to. So must possible conflicts between advocacy and representativeness, short-term and long-term interests, etc. Agreement is thus often reached at the least threatening level acceptable to all parties involved, and that is not always what is required to safeguard the public by objective criteria. Nonetheless, regulatory agencies, such as the U.S. Bureau of Foods, has wisely established a technical operations staff which analyzes the information needs related to the Bureau's scientific, regulatory, and management functions.

The proliferation of regulatory agencies, with the resulting specialization of each, has caused serious problems. The U.S. Food and Drug Agency, for example, said not long ago that it would not ban PCBs because it could not classify them as food additives; i.e., they were not intentionally introduced into food chains. It took another organization, the Environmental Protection Agency, to phase them out under the new Toxic Substance Control Act. The later requires a firm to prove a substance to be safe before it is marketed. Regulatory inconsistencies still exist and are likely to continue. An important step toward more consistent regulatory policies and more efficient regulation is the recently formed agreement (U.S. Federal Register, February 17, 1978, Part VIII) by the U.S. Consumer Product Safety Commission, the U.S. Environmental Protection Agency, the Food and Drug Administration and the Occupational Safety and Health Administration to work together as the "Interagency Regulatory Liaison Group" to improve public health through sharing of information and coordination of activities.

The information sources influencing the behavior of consumers, and thus indirectly the behavior of producers and regulatory agencies, are numerous and vary greatly in quality. Even in university communities all kinds of improbable information is communicated. The research underlying a story in a newspaper, on television or radio is sometimes done hastily, without thorough checking and understanding, and by people without the experience to evaluate reliability of different sources and inputs. Public interest itself does not necessarily gravitate to the most authoritative and competent sources even when people are familiar with them. Consumer behavior can also be quite inconsistent as demonstrated by the increase in demand for saccharin when banning it as a suspected carcinogen was proposed.

There are clearly two kinds of errors to be avoided in the communication of information about environmental hazards. The errors of omission are most serious. These involve the failure of the affected public to acquire the wisdom to avoid products dangerous to their health. By wisdom we mean acquisition of existing, reliable knowledge and understanding regarding which products are hazardous for them plus the commitment, habitude and attentiveness to use such knowledge and understanding in actually avoiding such products. It is, of course, only an error not to tell someone that a product is dangerous if in fact it is. Since the latter is never so clearcut, there is always some chance of making such errors.

We make an error of commission when we spread information that influences consumers to avoid products which are not only safe but meet important needs. Consumers must trade their conservative inclinations expressed by "Better safe than sorry" against their gambling, hedonistic inclinations expressed by "We must eventually die anyway, so why not enjoy life now, and it won't affect me anyway just now." It would be useful to know how people are distributed according to their behavior in such trades. Errors of commission also incur risks because a great deal of damage can be done by removing important goods from the market, the consequences being little understood and possibly more serious in the long run than non-removal from the market.

Both kinds of errors translate into costs to be used for evaluating the performance of the information or library system engendering them. In evaluating a total system or comparing two systems with regard to how low all the costs are kept, several difficulties arise. One is that of making costs commensurable. The cost of lives lost to cancer two decades after exposure to an environmental carcinogen cannot be easily compared with the cost to the dye industry or to labor in loss of jobs from removing Red Dye #2 from the market. Another difficulty is attributing to the information system its share in lowering costs, i.e., ascertaining how much of the variance in fluctuating costs is accounted for by one or another information system or some other cause. The proposed creation of experimental systems in a realistic user environment can contribute important steps toward clarifying some of these problems and in addition provide worthwhile services in their own right.

The goal of a perfectly hazard-free world, like that of a world totally free of disease, may not only be unattainable, but undesirable. By tampering too much with the natural regulatory mechanisms that maintain delicate balances among various species and their environments in the absence of a more complete understanding of these, we may do more harm than good (Dubos, 1971).

2. POTENTIAL CONTRIBUTIONS OF LIBRARIANSHIP

The number of environmental hazards is numerous and the issues surrounding each are complex. The most important hazards are associated with the man-made rather than the natural environment. Many hazards involve manufactured products. When a product is suspected of being hazardous, many interests and points of view come into play. There are the scientific researchers who are responsible for the validity and significance of findings bearing on the hazard or safety. They also check one another and try to resist temptation from decision-makers to agree that the risks in a decision can be eliminated. Then there are the consumers who want to be assured of safety and to continue trusting their suppliers. There are producers and distributors who want to maintain their reputations, sales and satisfied (and healthy) clients. They would prefer the results of scientific investigations before they invest in tooling up for production. Finally, there are regulatory agencies in the executive branch of government and legislative and judiciary bodies with responsibilities in this area. Each party needs knowledge to further its interests and mission and is likely to interpret information from its point of view. Yet, there is also a common core of knowledge and understanding that should be shared by all parties.

A library is in an excellent position to present all sides of an issue, to serve equally well all the interested parties. When we refer to libraries, we really mean the entire library system, including public libraries, school libraries, special information centers, special libraries, and data banks. Consider as an example the "International Cancer Research Data Bank". It was created by a 1971 act of the U.S. Congress for the purpose of collecting, analyzing and disseminating data useful in the prevention, diagnosis and treatment of cancer. One of its services is a computerized information retrieval system accessing several data bases. One of its products is a directory (ICRDB, 1977) which lists about 170 primary and 67 secondary publications, describes 59 of the larger libraries in 12 countries that stock cancer-related publications, describes special collections (registries, of slides, of tissues, etc.), describes audio-visual, data access, and automated services, and describes 31 information sources for research projects. Among the latter, for example, is a directory of on-going research in smoking and health, the 1976 edition of which contained about 850 resumés of such research. Another publication of the International Cancer Research Data Bank of relevance here is a listing of current research (NCI, 1978).

The above illustrates what libraries, in our extended sense, are doing. The sheer size and complexity of what is available is likely to overwhelm the interested parties. When they reflect that this does not even represent all sources of available information – industrial firms maintaining their own research do not always make every finding available and a great deal of what is already known at any time has not yet found its way into the system – they may feel even more bewildered.

What each interested party needs to know about the risks of possible carcinogens in products should be presented in the form of briefs. These should reflect a great deal of evaluation, screening, synthesis and abstraction of essentials. If consumer groups have not already organized themselves and perhaps engaged the services of someone who could brief them in this way, then public libraries could provide the stimulus and forum for them to do so. Industrial or special libraries could serve a similar function for the producers and national or governmental libraries could do it for governmental agencies.

To some extent, all these briefing experts would do what the mass media do now. The experts would work closely with reporters. To maintain the trust of their patrons and clients, these experts are most likely to be in their employ and represent their (possibly conflicting) interests. They are thus likely to engage in debates with other experts. Each expert must help his constituents trade the risks of errors of commission and omission. He must also, together with his counterparts, clarify basic differences in values and viewpoints among the various parties. The discussions may be controversial, possibly even taking the form of dialectics or adversary proceedings. In any case, they should be at the highest and most informed level made possible by the state of knowledge. In no way are sound policies likely to emerge from "the clash of narrowly based constituency interests, each one at war for its own special advantage without regard for the others or for the larger public interest" (Science, 1977). If librarianship regards its responsibility in the way proposed by Egan (1956) and Shera, et al. (1956) and somewhat modified (Kochen, 1973) to "maximize the effective and efficient social utilization of documented knowledge that is potentially attainable," then it could contribute significantly to resolving these problems.

Scientists should enter the deliberations as early as possible. Points where there are implicit differences among the participants - e.g., differences in outlook, values, time perspective, priorities, level of understanding required - need to be explicit and if they cannot be resolved, should at least be reduced.

3. SUGGESTED PROCEDURE

Recent developments in the area common to communication and computer technology make it feasible to organize and conduct the needed discussions in a new and more effective manner. This area includes computer conferencing, two-way cable television, video disks, citizen band radios, computerized searching of numerous data bases and some aspects of "artificial intelligence" or cognitive science.

To raise the level of discussions and resulting policies, we suggest an experimental system. Its aim is to help us understand better how the quality of discussions relates to the quality of policies for controlling environmental hazards. To illustrate the use of the proposed experimental system, let us focus attention on three users concerned with carcinogenic products. One user, C, is the expert who briefs and represents the general public consumer. The second user, I, briefs and represents the industrial producers. The third user, G, briefs and represents governmental agencies, such as regulatory bodies.

Suppose the C, I, and G each has a computer terminal in his office. Expert C enjoys expressing herself in writing and is reasonably fluent on a keyboard. Her terminal is right on the desk next to one of the telephones. Once a day she inserts a coded plastic card into a slot in the telephone connected to the terminal and that signs her on to an account number on an international network. Expert I prefers to communicate orally and has his secretary sign on for him every day, communicating with and through him while he is on-line over the telephone or an intercom. Should he wish to do this in his car while driving to and from work, he communicates with and through the secretary over a citizen's band radio. Expert G prefers face-to-face discussion and meets with his secretary while he is on-line every week or so.

Imagine that C initiates discussion by entering an item or public notice into the common file. With that item he intends to alert anyone reading it to a new report R about the carcinogenic effects of nitrosamines in animals and its implications for people who frequently eat hot dogs. It contains the suggestion that the levels of dimethyl-nitrosamine in hot dogs should be regulated. This entire transaction takes C but 10 minutes on the terminal, after which she is automatically signed off. The new item is cross-referenced with all relevant prior ones, indexed, and interfaced into an agenda.

When I next signs on, he sees that two new items were entered that he has not yet seen. One is by C, suggesting regulation of hot dogs. The other is by someone else. He asks to see the item by C. Having read it, he asks that copies of the referenced report R be sent to a number of designated colleagues for evaluation and comment. He also requests all citations to that report subsequent to its publication. Further, he asks for a list of all workers engaged at that moment in verifying its findings or investigating related problems. I and his secretary may sign off after 15 minutes at the terminal. The requested items would be automatically retrieved from one of the system's data bases - or else a request would be automatically dispatched to the report's author or one of the libraries containing it. These would be delivered by conventional mail or, if justified, telecommunicated.

G signs on two days after C entered the item (among others). He reads that item as well as a message from I, urging him to wait for an evaluation of the research or for more research. G now searches a data base for recent indications that the consuming public wants lower levels of nitrite additives in food. Within seconds he sees a report indicating that the number of messages on that question that have been received since report R came out have been increasing. He searches that data base to check whether the senders of the increased volume of messages were primarily educated, older, or high-income, and he obtains a cross-tabulation of degree of concern with level of education, age, socio-economic level, education. With one command G now transfers the cross-tabulated data to a programming system for statistical analysis, which he then instructs to give him correlations and regressions. After about ½-1 hour of on-line time, he signs off. He calls his co-workers responsible for this problem and asks them to formulate the position his agency should take. These may take into account summarized findings of the report literature indicating, for example, that the people who are most severely affected by environmental hazards are those who are least well informationally connected, such as the aged.

The discussion among C, I, and G may continue in this way over several weeks. Authors of various reports are brought in. Each participant can react to what any other participant enters at any time he feels stimulated and prepared. Through the computer conference, they may select a mutually agreeable time for a conference telephone call (with or without video) or a face-to-face meeting. While in a face-to-face meeting or on the telephone, the participants may also be on-line, supplementing one medium with the others.

There might be sharp disagreements. Industry representative-expert I might insist, for example, that minimal nitrite additive levels should not be lowered until more research establishes the need more conclusively. Consumer representative-expert C, mainly on the authority of the report R, insists that minimum nitrite levels should be reduced, and where their function is only to add color to food, to be eliminated altogether. G might state a policy for hot dogs already in production or on the market requiring lowered levels of nitrites but warning clients about the possible hazard, while for new products that require his agency's approval, proof be required that they are safe.

The discussion might then shift to the distinction between proving a product safe vs. proving that it is not a hazard. I might insist that safety and non-hazard are synonyms. C might argue that no evidence of carcinogenicity of nitrites in man is neither proof of safety nor of non-hazard. G might argue that government should go no further than informing the public. C might reply that only a small part of the consuming public heeds clear warning of hazard, citing evidence for that. And thus it continues.

At all times, anyone (with an account) has completely open access to enter and/or to observe the discussion through terminals, printouts, recordings, etc. in the public libraries. The experimental system should be run like a public utility with free access given to those chosen to be part of a random sample of the population in order to test specific hypotheses.

Libraries, in our extended sense, would not be merely sites or locations of terminals for the public to enter and participate in a discussion. Their resources would also play an essential and active part in the discussion. Through their expertise in referencing, cataloging and acquisitioning, they would ensure that as soon as they are generated, the most relevant and significant documents are known and available to I, G, and C as well as anyone else. Through their skills in management, they would not only organize and maintain these extended computer conferences, both in their hardware and software aspects, but in their human aspects as well. That means monitoring and ensuring a continuing and fruitful flow of discussion with occasional prods toward convergence and closure. Most important, their humanistic orientation should ensure that the discussions and the policies reached remain completely open, that all affected parties have the opportunity to be aware of what is occurring and in a timely way, and that they are conducted at the highest possible ethical as well as intellectual plane (Schwarz, 1976).

Ethical considerations are indeed central in alerting people to environmental hazards. The new information professionals who are to organize and manage the conferences we propose have shared responsibility for setting and maintaining ethical standards. There is an important distinction between legal and moral standards, one that may parallel the distinction between old and new information professionals. This has important implications for selection, education and training of new professionals. They should have a broad humanistic orientation with a balanced concern for the long-run well-being of society as a whole. Their task is not to draft a code of ethical behavior for their profession, but to behave in such a way that descriptions of their routine behavior could eventually be codified and serve as ethical norms.

4. EVIDENCE OF FEASIBILITY

The kind of system sketched is based on technologies and procedures now under rapid development (Linstone and Turoff, 1975). Computer conferencing has been maturing for some time and we are now witnessing a rapid expansion in the number of people involved. One reason for this is that computer terminals are widely available and becoming more so at lower cost. There are several million in use now in the U.S. alone. Nearly every library has one. It is very likely that within a year terminals with graphics capabilities on CRT displays, read-only memories and some local processing capabilities will be available in the $600 range in U.S. chain stores for home use.

To participate in a computer conference requires no special expertise or aptitude for programming. By coupling it to an ordinary telephone (at home or work), it is possible to access just about any computer on which the user has an account through a number of commercial networks (e.g., TYMNET or TELENET). The cost of using these channels decreases with traffic volume and may soon be in the range of $3-$10 per hour, almost independently of distance. Computer costs, too, have been rapidly decreasing at the same time that capacities have been increasing.

These advances in technology result from large scale integration of electronic circuits, which also make possible the mass production at relatively low costs of entire minicomputers and microcomputers. The latter have opened up a mushrooming market for computer hobbyists, similar to the market for citizen band radios in the U.S. It is quite likely that every modern local library will have such a minicomputer with several terminals for public access. The minicomputers would be used not only to help the librarians in their professional work, but would also be accessible to local users for simpler search and processing tasks. They can also be connected to larger regional computers, as well as to the international networks, over which computer conferencing, data base searching, cooperative cataloging, requisitioning, classification and interlibrary transactions would occur. The trend toward this is already unmistakable.

The number of interesting computer conferences now in progress is sufficiently impressive to suggest that users derive net benefit from participation and that there will be more net benefits to come as the number and quality of participants exceeds critical thresholds. To be sure, there are still many likely improvements before the use of such systems is as well suited to the users' styles of thinking and communicating as the telephone or even the dictaphone. Operating a keyboard is not easy for many people, but inexpensive devices for recognizing hand printing are under rapid development, and practical speech recognition devices may exist some day, too. Moreover, it may become as natural to key in text rather than write it long-hand as it is to key in numbers with a hand-held calculator rather than write them on paper for manual arithmetic.

Video discs, too, are about to make their appearance on the market (Laskow, 1977). Up to 6000 journal articles (54,000 pages) could be stored on a single disc resembling a phonograph record, costing about $10 to make, and very little to reproduce and mail. It is played on a video disc reader ($1500 including the TV set and a page printer) that attaches to an ordinary TV set, allowing the user to select any page or to scan serially. An initial master disc can be made by reading typeset pages directly onto the disc at 1¢ per page.

All these technological advances support the belief that discussions of the kind we imagined are technically feasible. This is not to say that face-to-face, telephone or mail contacts will be replaced. On the contrary, they are likely to be combined into an overall system, supplementing one another. Why, however, should people engage in discussions that are higher level, more open and more fruitful than is now the case just because of new technologies? And why are libraries in a position to bring it about better than other institutions?

The answer to the first question is that an available, feasible technology is only a necessary, not a sufficient, condition. It is necessary because without it C, I, and G, as well as a large participating public, would not be able to engage in the sustained, concentrated effort required to conclude a discussion with people outside of the employer's institution. Moreover, costs of travel for face-to-face meetings are increasing, as are the costs of people's time and of printed materials. On the other hand, more time is likely to be available for leisure and that is a role for the extended library.

The sufficient conditions for fruitful discussions toward public policies to control environmental hazards have less to do with technology than with major current social trends. In the U.S., after four decades, there is a vigorous movement to revamp the Food and Drug Administration, the major federal regulatory agency. A favorable climate has been created by the consumer movement launched by Ralph Nader, the generally higher educational level of consumers, the greater need for accountability by industrial producers, and the effectiveness of modern mass media in arousing and shaping public opinion.

The second question has two parts. The first is why libraries should, could and are likely to take the initiative. The second is why their leadership is likely to be accepted and result in success. Libraries should welcome new and vital roles at a time when library budgets compete for limited funds with sanitation, police, fire fighting and other municipal or national services. They should appreciate opportunities for more challenging, professionally demanding and prestigious tasks. Librarians must realize they have a great deal to gain from the increased visibility and stature thus afforded them.

Among the current generations of students trained in schools of information and library science there is an increasing number with the requisite ambition, technical and managerial expertise and background to accomplish what is required. If they succeed in mobilizing the needed resources, then they are likely to succeed in their enterprise. But will these resources be made available to them in competition with others? That depends in part on whether the importance of information is recognized by those who decide about resource allocation. It also depends on whether this new generation of library/information scientists will prove themselves ready to use the resources effectively. There are small bits of evidence that this may occur within the next decade. We can help to make this happen and argue, in this paper, that we should.

Institutions competing with libraries for leadership in providing forums for the proposed discussions are many. They include universities, government agencies, mass media, etc. None offers as close to and as responsive a channel for input from the general public as public libraries. If they capitalize on this potential, they should succeed. Universities are too remote from the general public, and this experimental system is more remote from their main mission of education than from the library institutions. Governmental agencies are less trusted as being objective, professional, responsive and are seen as dominated by political concerns. So are banks, insurance companies and other business and industrial concerns. Bodies such as the New York Academy of Science can and do provide a forum, by sponsoring the "International Conference on the Public Health Control of Environmental Hazards on June 28-30, 1978. But this is a one-time affair and not available to a wider public. It illustrates one of the important inputs to the kind of library-linked information system we are proposing.

5. CONCLUSION

This paper calls for action by libraries toward the creation of improved, new means of communication among people about the most advanced knowledge relevant to the control of hazardous products. This is very much in the spirit of Bjorn Tell's thinking, particularly as it involves the wise use of technology, the development of international networks and the use of an evaluation rationale underlying the design. In 1970, he proposed a Scandinavian information network (Tell, 1970, from Samuelson, 1971). As a member of a task force (Piganiol, et al., 1971), he urged that national governments ensure: Availability of information for national needs from all sources; that important information be properly selected, digested and analyzed;

availability of funds for user studies and developing new techniques, as well as for establishing and operating information systems; that those responsible for coordination have the breadth of view, management skills, appreciation of user needs and balanced understanding that is needed. All these desiderata apply directly to the task proposed here. If they are met, the system we propose is likely to emerge, despite some barriers.

We should now ask whether that is likely to be a good thing. One may ask how better discussions leading to safer products could possibly not be a net benefit. To see that, we should explore some of the social barriers to and side effects of such a system and the possible social costs of dissolving or surmounting such barriers. One barrier or side effect is the fear of widespread opportunities for the invasion of privacy and control over large populations that open access to such networks could bring. Another is the danger that infusing science at the levels necessary to enlighten the level of debate may disenchant much of the public. The inherent hypothetical nature of science may be foreign to decision-oriented people in law, business, and government, resulting in a distrust of and disrespect for science. Moreover, it may fuel confusions between excellence, elitism and/or inequities.

Possibly these side-effects are as unavoidable as the substitution of one product (e.g., Red Dye #40) as a food color additive not known to be carcinogenic for another that is suspected of carcinogenesis (e.g., Red Dye #2). Possibly the newer systems, together with their side effects, will arrive whether we plan and will them or not. If that is so, we can at least prepare to cope with the anticipated side effects. We are not likely to start this unless the importance of such studies is urged upon us by the existence of at least an experimental system of this kind.

We therefore recommend to readers that they initiate and support the creation of an information system of the kind sketched here. Initial support could come from national or multinational health programs with a strong commitment to prevention. The initial main thrust in developing the system is to make it a good research vehicle for the purposes of:

(1) helping us arrive at better evaluation criteria;
(2) learning to design such systems;
(3) shaping the role for new information professionals;
(4) training such information professionals;
(5) demonstrating the possibility of meeting an important social need for contributing to the prevention of such a disease as cancer by controlling products that are likely to be hazardous.

An experimental system of the kind we propose, that realizes its promise at least for research and education in a specific area (such as alerting people to potential carcinogens in food), might serve as a model for similar systems in other areas. We face hazards not only because of our excessive claims on the biological environment - overgrazing, overfishing, excessive deforestation (Brown, 1978) - but from our increasing dependence on a man-made environment we may not know how to make more hazard-free without uninformed tampering. Learning this is one of mankind's greatest challenges and opportunities at this stage in history.

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"ONE GENERATION OF INFORMATION ACTIVITY - THE PROBLEMS OF THE NEXT"

By N.E.C. Isotta

> *"Begin at the beginning," the King said gravely, "and go on till you come to the end; then stop."*
>
> *Lewis Carroll*
> *"Alice in Wonderland"*

1. THE 1950's

It is not often realised that in the past 20 years, information retrieval methods have ranged from the use of Peek-a-Boo and punched card systems to the present highly sophisticated on-line access. Twenty years ago the problems which were typically being considered were "how many accessions should one try to include on a Peek-a-Boo type feature card?". Many had a capacity of 1000 originally, but this was soon pushed to 10 000. Then, could the total system handle 50 000 or 100 000? At these magnitudes, the accuracy of hole placement became important, and the material of the card had to become robust but still drillable. Slowly machinery was developed. Special drills, guides, clamps and eventually mechanised optical readers, etc.

As volumes grew, those concerned with handling the scientific and technical report literature sought faster and better methods of dealing with the material. Unlike the classical library operations where growth of book stock was largely controlled by budgetary considerations, the various classification systems such as UDC were mainly unsatisfactory. In the main this was because these schemes, in attempting to be universal, suffered from an inability to be updated in less than 5 to 10 years. The result was that the increasing flood of literature dealing with modern developments in a wide field of applications, simply could not be properly indexed for subsequent retrieval. In a way, this was the initial strength of Peek-a-Boo and the punched card sorting systems which thrived first on Uni-Terms (after the latter manual system had expired because of the sheer volumes involved). There also seemed to be an innate aversion by the practitioners of the cult (mainly information officers in large concerns) to the use of arbitrary coding techniques. Many systems were developed and tried during this expansion period when it was beginning to be appreciated that the forecast information explosion had arrived. Current awareness also began to be seen as the solution. After all, if everyone was kept informed of developments in their field, the problems of retrospective searching might become more limited, thus making SDI, a system much appreciated by users at the time, of considerable value to the information handlers. Associated schemes such as KWIC (Key Words in Context) also began to be used quite heavily.

2. EARLY 1960's

Basically, the scene at the beginning of the 1960's could be described as in a state of flux, even confusion. Systems were being run on computers quite extensively; the IBM 1401 and 1410 machines played important roles in the development of "batch systems". However, problems of machine compatibility were beginning to emerge not only in terms of byte or word machines, but in terms of tape bit density, format and content. Databases were largely the province of government agencies such as NASA and the USAEC. In Europe generally speaking individual bodies, such as government departments, large firms, university libraries, were themselves preparing databases either directly from the literature itself or via secondary publications, the latter not yet having realised that the tapes might be also a secondary source of revenue. Unfortunately, even here the methods of input were legion - punched cards, punched paper tape, optical readers etc. The formats and the contents were even more varied. By about 1963/64 however, well produced, closely controlled tapes of indexed references began to be available. For example, NASA tapes date back to 1962 and have always represented the highest quality. In the case of SDS, as an information service, the availability of these tapes from NASA was the vital factor which made possible the building of the service as it is today.

3. LATE 1960's

The NASA file, made available through a generous agreement with NASA, made it feasible for SDS to begin its first batch processing operations on a file of about 200 000 items, i.e. only two to four times the size of a viable Peek-a-Boo system!

Initially, operations commenced on a General Electric machine (GE 415). There were many compatibility problems - even reading the IBM tapes produced by the NASA system was a difficulty. Eventually, in 1967 this operation was discontinued and batch searches run by NASA for ESRO (European Space Research Organisation) on its own computer system in Washington. By 1969, the file had grown to over 400 000 items, with batches of 30 searches taking about 20 hours of computer residence time, and correspondingly expensive. Was this the end of the road? After all, there had been many discussions on the merits of linear and inverted searching, mostly showing that it would be too difficult and too costly to maintain inverted files. However, now here was a batch system based on linear searching, which appeared to be coming to the end of its useful life at a file size of 400 000 items.

4. IMPACT ON THE USER - AND THE INFORMATION WORKER

Before looking at the solution to this problem, what was happening to the actual user of this system, i.e. the man who wanted the information? He had by now become rather remote from the actual searching. In view of the expense and the consequent necessity to batch, he was also beginning to wait rather a long time for his information. And, of course, unlike the service he was receiving from his librarian, it was only a list of documents he was getting, not the reports themselves. Furthermore, instead of a handy, easy to understand, card catalogue with direct access to the book stocks, he had now to worry about Boolean logic equations, particularly if he wanted current awareness (SDI) searches, which had to be checked, tested and confirmed, before being passed as fit for a monthly run.

Then there was the problem of noise, false drops, recall, precision, controlled vocabularies, thesauri, uniterms, keywords, up-posting-down-posting, related terms, generic terms, etc. etc. At this stage the user himself was hardly involved; only the information specialist could handle the system. Even for him, it can hardly be said that the techniques of information retrieval had been greatly simplified, and in the process of trying to use the system, new skills had to be learned. The customer was often left dissatisfied, and uncertain that he had really got what he wanted - often he got nothing and sometimes too much.

5. THE ANSWER TO THE PROBLEM?

The solution was two-fold, a step forward in computer technology, as exemplified by the IBM 360 series together with increased mass storage capacity, and the implementation of on-line real time searching, pioneered by Lockheed with its Dialog system in 1967. In Europe, with a two year delay, ESRO in 1969, implemented ESRO RECON on the IBM 360/65 in its satellite tracking and control centre in Darmstadt. Remote terminals were installed in the Head Office in Paris, and in its main technology centre ESTEC in the Netherlands. One file, NASA, at 400 000 items, was stored in an IBM 2321 data cell. As with most new systems, start-up was slow, although it must be remembered that the important advance making on-line available to the masses, i.e. dial-up, had not yet arrived.

6. THE USER AGAIN

In Europe, as in the USA therefore, on-line searching was only available to those who could afford expensive high speed terminals and leased lines. Inevitably, such access remained initially largely the province of government information centres, government sponsored university activities, and in the case of SDS, of space oriented research and development centres. Possibly the impact on a direct user, and the real potential of the system, was masked by its initial costliness. As in the days of batch processing, which anyway at this period was still running concurrently, the user was still separated from the actual system.

For the information worker, however, life was at this stage somewhat simpler. In effect, all that had happened was that the construction of profiles off-line had now become possible on-line. The result was a considerable improvement in search success and a great gain in time. The user saw little difference, since he was not in general exposed to the results of comparison between batch and on-line searching, and thus was not necessarily aware of the improvement.

7. THE EXPLOSION OF THE 70's

It was certainly predicted by a number of writers. Somehow it seemed fairly remote - no one would really want to search it all at once, except possibly if searching for a large cross section of the public. But the concept of searching by the public had still not arrived, except in some small experimental systems. Using the growth of the SDS database as indicative of the general trends, the following emerges:

TABLE

YEAR	DATABASE SIZE (millions)	INCREASE	SPECIAL EVENT
1966	0.2	-	Begin Batch Processing
1967	0.26	0.06	
1968	0.32	0.06	
1969	0.4	0.08	Install RECON
1970	0.5	0.10	
1971	0.9	0.40	Begin to add other files
1972	1.25	0.35	
1973	1.8	0.55	
1974	3.6	1.80	
1975	4.7	1.10	
1976	6.8	2.10	Begin Dial-Up Access
1977	9.4	2.60	

Thus by the end of 1977 as many references were being added in 1 month as were previously added in 3 years (1967-1969).

The really significant column is of course the third, showing the actual progression in the increase of the database - the explosion effect is clearly seen (Fig. 1). From this it would appear that the increase will continue unchecked until one of four things happen:

- the increase in the literature slows down
- the continuing increase in database size can no longer be economically supported
- the "system" (computer, software etc.) can no longer cope with the volumes
- older material is removed.

The most likely event is the second, although this could be almost indefinitely postponed by the appearance of larger, and cheaper, mass storage devices. The third event will also be staved off by new generations of computers, so that the significant controlling factor would still appear to be the exponential increase in the literature available. However, and with regard to the fourth point, in the last ten years very little significant work appears to have been done to determine the "value" (use made?) of older literature available on-line. A serious study of this matter has to be made soon.

8. THE MID 70's

This period saw the beginning of the further extension of on-line searching to the masses via dial-up access. Tymshare was one of the first exploiters of this market and by late 1974, early 1975, the US on-line system operators were already connected. Europe had to wait until late 1975, early 1976, before such access was really available. SDS for example was connected to Tymshare at about this time, and also began to offer access in 1976 to ESANET (the network of the European Space Agency, successor to ESRO) by special concentrators installed in national centres. In addition, during 1974, plans for EURONET were also being mooted, and in general, networking, for the specific purpose of permitting low speed dial-up access to bibliographic databases, became the major development area. In other words, effort was heavily concentrated on the delivery mechanism to the user, but possibly a disproportionately low effort was going into the further development of on-line searching techniques. To a large extent attention was being diverted from the real problem of handling constantly increasing files by forays into such irrelevant matters as multi-lingualism, although a major advance was made with the introduction of full text searching. However, the pipe dream was being realised, the availability of that valuable commodity, information (knowledge?) for the masses. According to Boswell, Johnson said:

> *"If it rained knowledge, I'd hold out my hand; but I would not give myself the trouble to go in quest of it."*

Privately, many information workers felt that the users would never be able to handle what was being offered and would not want to give themselves too much trouble to understand the system. There was also detectable a tremor of unease in the information community. Was this the equivalent of the Industrial Revolution? Were these developments going eventually to deprive them of their jobs? Questions of this kind still emerge today. The answer is, of course, on-line searching and access have compounded other difficulties, and the experts have become even more essential.

9. THE ACCESS EXPLOSION OF THE LATE 70's

The drive continued. In 1976 Tymshare was joined by TELENET, while EURONET was scheduled for late 1978. ESANET was already, in 1976, connected to CYCLADES and access to SDS was also available via Tymshare. In 1977 TYMNET emerged with the official blessing of the PTTs, and the interconnection of SCANNET to ESANET was agreed in principle. Forecasts were made everywhere (some more valid than others) of millions of users and millions of searches by 1980. It seems to have been generally assumed that the technology of information retrieval, dating from the late 60's, was still going to be valid in the 1980's. The main problem was only who would run what and where. The fact that Lockheed Information

Services and System Development Corporation in the USA, together with the Space Documentation Service, were offering over 30 million document references on-line to almost anyone, appeared to be ignored. The technical dangers of this situation were possibly masked by the relative efficiencies of these operations, and by extraneous, political factors.

The growth in access facilities and consequent increase in the number of users, together with the predicted growths as further access facilities become available would indicate that all is well. However, access is also becoming more complicated. Networking standards such as X25 are being introduced; facilities are to be upgraded by packet switching techniques; various softwares are to be inflicted on the masses, although in Europe palatability is to be ensured by the EURONET standard command set. The value of such a standard would be immense, if it were just that, but inevitably certain software idiosyncrasies will not be ironed out so that users may well make fatal mistakes without realising it. The technology of the distribution system is the current focus of attention and various advanced networks are being designed and built. More and more "peripheral" people with special skills have to be employed - but they are not directly helping to put one additional reference into the users' hands. On-line, the tool for the end user, has become more and more sophisticated, more facilities and more power have been provided, more commands, more telephone numbers, more network access methods, more different softwares, more access points to the files, and more files. The end-user is being driven back into the hands of the professional intermediary, again putting barriers between him and the information.

10. THE 1980's

If the comments made in chapter 7, about further file size increases continuing unchecked in the next few years, are accepted, older material is not removed, and no "political" decisions intervene, the SDS database could theoretically double in size in the next two years. Obviously this will not happen due to some of these factors - but it may happen with the American services, particularly if the cheap mass storage forseen for the 80's becomes available. It is even more likely, if these services decide to add more old references, rather than remove them. Strangely enough, we are turning full circle, back into a problem of the 1960's: the maintenance of inverted files. We can now add a fifth factor to the events which might check growth

- the human element required to run the machine system becomes overloaded.

The updating of the inverted files is not now just a new, but manageable task, it is beginning to overshadow the other active system elements. If we take another look at the SDS system, we see currently some 17 files on-line. Initially, when the NASA file was the only file available, there were three inverted files - or three access points (excluding accession numbers). These were: Author, Corporate Source and Keywords. The latest files to be loaded by SDS have an average of ten, and on a database of some twenty files this can mean up to 200 inverted files. It is probably unnecessary to stress this further, particularly if current US capacities are considered.

Assuming that batch processing is taken to be at a level of complexity of 1, a purely arbitrary representation of European increases in system complexity during the last ten years is shown in Figure 2. Only major, generic milestones are indicated, but these show that present day systems are about 9 times as complex to use. Two thirds of this increase has occurred in the last five years.

Thus we can conclude that the next system generation is overdue from the point of view of the system operator who needs faster, larger storage and increased computer power. There must at the same time, however, be a considerable simplification of the user interface. In other words, the tendency to continue to complicate the users' operation of the system by making more and more sophisticated use of the growing capacity, must be reversed. We have to come back to the original, now rather obscured, secondary objective, i.e. to enable the user to say "my question is", and to find the answer himself, with the minimum aid and in the shortest time. The main, primary objective in all this has still been overlooked, i.e. to deliver the document itself.

11. THE REAL NEED

A psychological factor has to be considered. Top management will not personally use machine systems unless only one or two operations are involved - anything else must be handled by a machine operator. Lengthy typing sequences are the province of clerical assistance. Middle management will condescend to use a desk adding machine and, in the USA only, also a typewriter. To a certain extent these levels are sceptical of on-line retrieval systems. To the extent that such levels are also scientifically oriented, they are even more negative. At least the middle management attitude towards these systems has to be improved and this is certainly feasible if development now takes the right direction. To a larger extent, top management is surprisingly unconcerned about posterity and consequently retrieval, being more worried about achieving targets and balancing budgets. However, with the increasing emphasis on databanks, it is even possible that top management will also turn to the on-line systems for factual, not reference, information, so long as system use is simple. Reference systems will remain largely with the information worker particularly while it remains as difficult as it is to obtain the actual document. Experience both in NASA and ES[illegible] has shown that at working levels, dependence on the professional information specialist has increased rather than decreased, whilst management has tended to try to overlook the enormous potential at its fingertips.

Within the next five years it will become increasingly easy to access a wide variety of databases via a number of networks. Networking will turn to satellite systems for greater reliability and for the inherent broadcast capabilities. TELENET is already making use of such systems and other important US developments are in the offing. Have we taken the wrong road in concentrating on distribution systems, when they will soon anyway be available in a variety of ways? Should we perhaps have concentrated more on the technology of information retrieval itself and on methods of document delivery? I think the answer, for Europe, is yes.

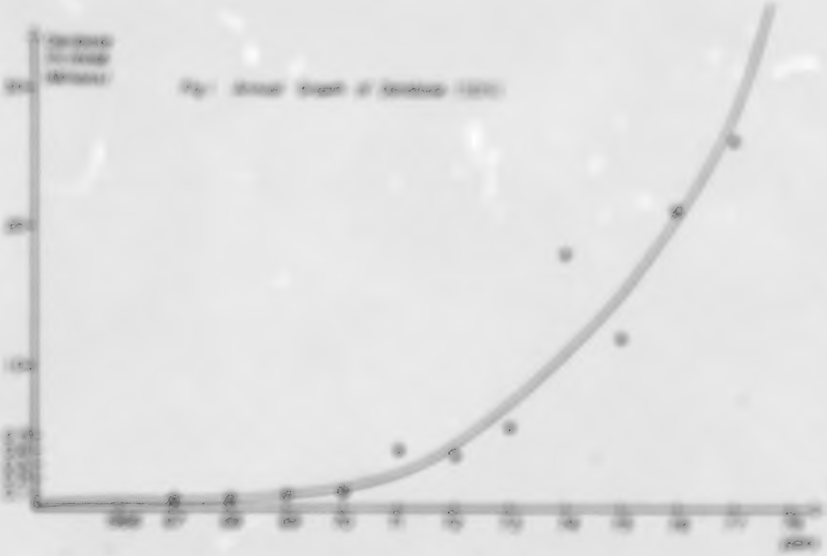
The European Space Agency this year, 1978, will launch OTS, its first telecommunications satellite. Opportunities for experiment are provided, and SDS hopes to make a contribution to solving the problems of document delivery, by exploiting these opportunities. If European networking is to remain not more than two to three years behind the US systems, then further developments through the use of European satellites are also needed.

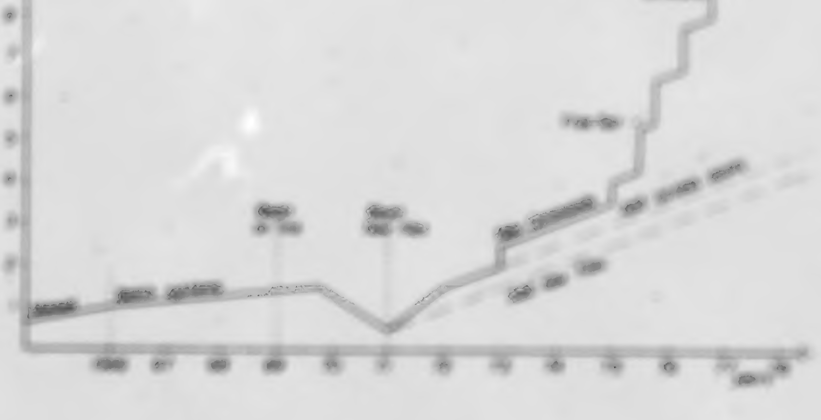
Even more essential, is a simplification of the methods of on-line information retrieval. If increased system power and capacity result in further complexity through new commands and more files, there is a real danger of total system collapse, if only through user rejection or increased cost of utilisation. The powerful command structures now available should only operate internally in the system, and should not necessarily be visible to, or used by, the searcher. Ideally, he will only speak to the "system", say "my question is" and then go away until the results, the references or the data are available.

It is perhaps appropriate, in the "curiouser and curiouser" circumstances that currently increased computer system power and capacity mean greater complexity of use, to end with another rather familiar quotation from Lewis Carroll:

> *"Now here you see it takes all the running you can do, to stay in the same place. If you want to get somewhere else, you must run at least twice as fast as that."*

From "Through the Looking Glass"





INFORMATICS AND LIBRARIOLOGY: COMMON TRENDS AND FUTURE

By A.I. Mikhailov and R.S. Gilyarevskiy

The interrelationship of library science and informatics is determined to a large extent by the interrelationship of librarianship and scientific-information work. We believe that these two distinct human occupations within the general system of scientific communication have different tasks and aims, which predetermines the independence of the scientific disciplines concerned with their patterns.

The information activities of scientists have always been connected with the operation of libraries, the librarian helping the scientist in book selection, alerting him to new books, and providing him with the necessary material. For millennia the library has been the only social institute to gather and summarize the experience of information service to science. This experience has been reflected in library science.

Even in the 19th century most of the library users were scientists, and very few at that. With the growing literacy and educational and cultural standards of the population the readership patterns changed considerably and the libraries underwent differentiation. Scientists and practitioners no longer constituted the majority of library users, and the principal task of the libraries — more particularly public ones, though special ones largely as well — has become that of ideological and cultural education. It is in this direction that the specialization of librarians has proceeded, librarians turning more and more into ideological workers, educationists and knowledge promoters among broad sections of the population. It was not until the middle of the 20th century that library services for scientists and practitioners began to be developed intensively in special libraries.

On the other hand, scientific-information work, which became established as an organised line of activity also in the middle of this century, began by tackling the problems of information retrieval which until then was the private concern of the individual scientist. True, the inadequacy of many research libraries impelled early information services to duplicate some library and bibliographical functions, but this has never constituted their main work. The principal achievements of informatics during the first decade of its development were in the domain of coordinate indexing, criteria for constructing descriptor information retrieval languages and thesauri, devising new kinds of machine-produced indexes, that is problems that have not been as much as posed by traditional library science.

Thus, while informatics is in some degree historical descendant of library science, the inherited experience has been completely reapprised. By now informatics has by far overstepped the range of problems with which library science is concerned, and is aiming at an overall investigation of the general patterns of all the processes of scientific (scientific only) communication. As for library science, it also greatly exceeds the bounds of scientific communication since librarianship provides for the public use of all written, printed, etc. records, i.e. all kinds of social information (aesthetical as well as logical). Besides, whereas scientific-information work has for its objective only to increase the efficiency of R & D activities, librarianship uses its special approaches and techniques to help find solutions to problems facing mankind and its individual classes.

The functional independence of the two occupations and the relevant disciplines under discussion stems therefore from the difference in the tasks that confront them and the scope of social information covered by them. But this independence, far from presupposing isolation of these disciplines, is conducive to their interaction. "Information science, then", writes J. Shera, "is not antithetical to librarianship; on the contrary, the two are natural allies, and librarians should not reject this new intellectual relative, nor should the information scientist discredit the librarian. Both have made and will continue to make mistakes, and if the librarian is the more guilty it is only because he has had more time in which to err" (1).

Further, a warning seems to be in order against a view that has gained some currency of late, namely that informatics is a more general discipline with regard to library science and some other disciplines which have for their objects individual scientific communication processes, e.g. theory of editing, book science, bibliography, archival science, etc. Equally unproductive have been attempts at constructing an hierarchy of information sciences according to information kinds. One hears of the need to develop science informatics, sociological informatics, aesthetical informatics, etc. with informatics becoming a general science.

We should like to say on this point that scientific disciplines arise, not from logical constructs of their necessity but from actual prerequisites, which are not in evidence in this particular case. Generally, a system of scientific disciplines does not evolve in keeping with an hierarchy of possible study objects. Therefore, it is equally illegitimate to regard library science as a part of informatics and to consider informatics a new direction of library science.

A few words about the organisational aspect of the problem. Each phase in the development of any activity calls for a certain organisational policy. In order to boost information services, a number of large special libraries establish information or reference-information divisions. On the other hand, in order to enhance the role of special (research and technical) libraries within the state-wide system of scientific and technical information, a number of countries (including the USSR) incorporate these libraries in information agencies as their structural divisions. These organisational measures which are dictated by specific conditions and are aimed at solving specific tasks during a certain developent stage, can have no part to play as regards the solution of the major issue of the independence of the library and the information centre, librarianship and scientific-information work, library science and informatics. Unless this independence is recognised the problem of their interrelationship cannot be raised, which is one of the most pressing problems of today. This is best seen in examining the educational aspect of the relationship of library science and informatics.

Over the past decade there have been more than enough statements of both librarians and information specialists to the effect that information disciplines should be taught at all levels of library training. In 1964, Don R. Swanson, opening the 29th Annual Conference of the Graduate Library School, University of Chicago, dedicated to the intellectual foundations of library education, had this to say: "The fields of information science, information technology, information retrieval, and documentation will not be treated as separate topics but rather as an integral part of library science, especially insofar as they make their own contributions to our analysis of the intellectual foundations. Thus we shall not be concerned with whether information science is part of library science or vice versa, but rather we shall assume that the educational process in a graduate library school must adequately take both into account" (2).

Similar ideas were voiced by many participants of the conference, notably by the outstanding representatives of American library science V. Slamecka and M. Taube. In their joint report they wrote: "At the present time we are witnessing the establishment of a multidisciplinary profession called information technology and of field of intellectual endeavor called (by some at least) theory of information systems. Their fundamental objective is to use current implements, intellectual and mechanical, to furnish the methods and systems for solving two areas of information service: a rapid and rational dissemination of information, and its long-term storage in a form in which it can be efficiently queried and retrieved. This objective must strike all librarians as differing from professed services of the library profession only in the method it uses" (3).

Unfortunately, much less is being said and written about the significance of advances in library science for improving scientific-information work, and about the need to teach the main parts of library science in training information officers. However, this is a no less topical aspect of the issue than the former one. It can be argued with certainty that the level of elaboration of descriptive cataloguing problems in library science and bibliography, which is the result of the most thorough analysis of modern published works, is far from having been assimilated in the relevant parts of informatics.

Closer knowledge of the achievements of library science in individual work with the reader, in reading psychology, and educational foundations of library and reference-information services would give a new impetus to research in informatics, for instance, as concerns to the still vague problem of relevance and pertinence.

We shall proceed from the premise that the interaction of these two independent disciplines must be of equal intensity on both sides. As of all the library types it is the special (scientific and technical) libraries that maintain the closest ties in their practical operations with scientific and technical information centres. Wherever librarianship and library science will be discussed in this work their particular parts dealing with special librarianship will be meant. The meaning of the following two terms calls for some additional explanation.

Scientific-information work is an institutionalised variety of scientific labour which is pursued in order to increase the effectiveness of scientific work proper, and consists in the gathering, analytico-synthetic processing, storage and retrieval of recorded information, and its presentation to scientists and practitioners in a convenient form.

There are many kinds of information service for scientists and practitioners which may vary in the clientele served (information publications, or selective dissemination of information), in the time period covered (current awareness or retrospective searching), in the method of information dissemination (direct supply of documents or bibliographic alert), and in other criteria.

The trend in scientific-information work is that as the research, engineering, and scientific-organisational labour in the various areas of science and technology grows in sophistication, and the special languages of these areas get more and more formalised, these areas will delegate to organisationally separate information services increasingly complex tasks of selection and processing of scientific information. However, the ordering and processing of information in this case are not done to obtain new scientific knowledge, which is the professed aim of research proper, served among others by scientific-information work.

Informatics is a scientific discipline which is concerned with the structure and general properties of scientific information, as well as the patterns of all scientific communication processes. This definition and the term itself were introduced in the Russian language by the authors jointly with A.I. Cherny as early as 1966 (4).

First, the discipline itself. The questions of whether it is an independent discipline and what is its nature began to occupy the minds of professionals as far back as the late forties, when scientific-information work began to establish itself as an institutional activity in many countries of the world. At first, there were attempts to deal with it in an easy way by extending and modifying the familiar notions of the past. For some fifteen years the arguments centred around the point of whether scientific-information work differs in any essential aspects from library and bibliographic work and how the term "documentation" should be applied so as to better reflect the special features of scientific-information work.

The recent years have brought an understanding of the fact that the discovery of essential regularities, which is the objective and base of any scientific discipline is only possible if the study object of this discipline is not confined to scientific-information work but is extended to the whole multitude of interrelated processes of scientific communication. Also, it has become clear that a more thorough study must be made of the structure and general properties of scientific information, which constitutes the main content of these processes.

We regard informatics as an independent scientific discipline with a study object of its own which belongs to the complex of social sciences, as the scientific communciation laws that it investigates are of social nature and characteristic of social phenomena. In very broad terms, informatics is divisible into the following parts: general informatics (the object and methods of study, the structure and properties of scientific information, scientific communication (informal and formal processes, scientific-information work), information retrieval, dissemination and use of sientific information, organisation and history of scientific-information work.

The major theoretical tasks of informatics are to reveal the general patterns of scientific information production, transformation, transmission and utilization in the various fields of endeavour. Informatics does not concern itself with the study and development of judgmental criteria of the truth, novelty and utility of scientific information, or methods of its logical processing to obtain new information, as all these are the tasks of the appropriate information-related disciplines, such as physics, chemistry, biology, etc. The applied problems of informtics are those of devising more effective approaches to and techniques for carrying out information processes, and establishing an optimal scientific communication system both within science and between science and production.

Now to the term "informatics". The need for a common, internationally accepted term to denote this discipline has been felt acutely in recent years. The term "documentation" which was introduced by P. Otlet as early as 1905 and has become widespread since, is now regarded by many authorities as obsolete. New names based on the term "information" begin increasingly to be used in different languages. The term "informatics" has been formally accepted in Russian (5). In English, the most popular term for this discipline is "information science". The American Society for Information Science (until 1968 - American Documentation Institute) gives the following definition to the term: "Information science is the science that investigates the properties and behaviour of information, the forces governing the flow of information, and the means of processing information for optium accessibility and usability".

Our analysis of the subject-matter of study aids for library science and informatics made some years ago (6) has revealed that the content of instruction in each of these disciplines, although differing considerably due to their independent nature and development, tends to display certain features in common. These features which are manifestations of some general trends in the development of library science and informatics during the present phase of the scientific and technical revolution, can be formulated as follows.

Informatics, followed by library science, in identifying its place among the emergent scientific disciplines and in defining its subject-matter and research methodology, has been making increasing use of the systems approach to the study of scientific communication.

The study of the main patterns and properties of scientific information is still in its infancy. However, some textbooks and, more particularly, popular books addressed to the general student and library and information user do try to present the modern views on the properties of scientific information and the laws governing its generation, transfer and use.

And lastly, many textbooks in both library science and informatics pay major attention to the problems and technology of mechanisation and automation of information processing. Here one sees particularly well the common ground of librarianship and information work, which is to raise the effectiveness of the intellectual efforts which are expended in processing documentary information.

We have established in the Introduction that librarianship and information work can be regarded as successive stages in scientific communication. This explains the fact that library science and informatics have common objects of study. Today, however, this study is conducted from different positions without taking cognisance of the common ground which is the direct consequence of the unity of internal machinery of the communication system. The steps taken by both disciplines towards a systemic study of common objects may lead to the discovery and formulation of objective regularities underlying scientific communication.

The systems approach to the study of processes that occur at the junction of cognate subjects is growing in popularity as the general approach and research technique at this stage in the evolution of science. " . . . In the sciences, the proper understanding of certain phenomena, or certain real systems, requires their observation in the broader context of larger systems which now include the systems studied traditionally by the different fields".

The theoretical basis of this approach is furnished by general systems theory the essence of which is briefly described by M. Mesarovic, a prominent American cybernetician, quoted above. This is what he says in the same work: "General systems theory is a scientific undertaking concerned with the study of the behavior of general systems . . . a general system is given either in terms of mathematical equations or computer specifications, or a physical analog, or a verbal description, etc., and the objective is to discover the basic properties of its behavior". For example, when approaching the study of any system, one would like to know whether the system is open or closed, what its structure is, how the state of the system can be described, etc. There are other properties as, e.g., stability, which might be of special interest in some problems but of minor importance in others" (7).

In a systems study of special phenomena some caution must be exercised in defining systems for study, as not infrequetly any multitude of interlinked processes or phenomena is taken to be a system. "A most important attribute of a system is that it possesses a certain integrality, i.e. that the entropy of the totality of the components making up the system is less than that of a simple aggregate of interconnected and interacting objects and phenomena. If the definitive characteristic of a system were merely the presence of interconnection or interaction between objects and phenomena, any set of these could be called a system, since all objects and phenomena are to a greater or lesser extent interconnected and interacting with each other. In that case, it would be senseless to introduce the concept of "system" (8).

The recent research in the science of science, library science and especially in informatics bears out that scientific communication processes do not represent a mere totality but constitute a system in the above sense. The properties and regularities of the scientific communication system discovered by this research permit a new view to be taken on the subject-matter and methodology of the disciplines in question and offer new practical possibilities for improving the associated fields of activity.

We are gradually coming to the realisation that the scientific communication system is a highly ordered social system based on the interaction of the humans, the operations of the relevant social institutions, and the observance of certain social norms. The elements of this system are dynamically interrelated in such a way that changes in one is sure to affect the operation of the others. This relationship exists at least in three dimensions: functional, social, and economic. Introduction in the training for librarianship and information work of even the bare facts about the properties and regularities of this system as well as its quantifiable parameters would make it possible to materially improve the efficiency of librarianship and information work, which represent the final and therefore decisive processes of scientific communication.

In defining the properties of the scientific communication system in the spirit of the general systems theory requirements, it should be noted primarily that it is an open system as it possesses all the attributes of one. The scientific communication system is not completely isolated from its environment: it has "disturbances" or uncertainties. It is an adaptive or self-organising system inasmuch as it responds to experimentation in such a way as to cause permanent changes in its behavior. And lastly, this is a system with which the experimenter is interacting, i.e., while influencing the system he is, at the same time, influenced by it. (The experimenter is "inside" rather than "outside" of the system during experimentation).

The scientific communication system is distinguished by a singular stability with regard to any outside influences, to which it reacts but slowly and insignificantly. This is accounted for by the stability of the scientists' behavior in approaching information problems, the invariability of their basic motivations, and the key part played by writing, and by scientific and technical literature in the transmission of information in space and time.

The scientific communication system is hierarchically structured, which is to say that the most steady state that the system tries to achieve in the process of self-organisation is reached when the system assumes an hierarchical structure. For example, any multitude of periodical publications on a subject or discipline, functioning in a natural environment, will eventually come to be self-organised isolating a small "core" of the most important highly subject-oriented journals followed by a much greater number of less subject-oriented journals, etc., which means that an hierarchic structure will have been formed. Any invisible college, which begins as an association of a few prominent scientists, will inevitably isolate, in virtue of the sheer numerical growth of its membership, a more limited group of leading scientists, or "core", i.e. it will form an hierarchy of membership within the invisible college.

And finally, this is a very complex goal-seeking system which has a large number of different and conflicting goals as well as a corresponding number of goal-seeking subsystems. In contrast to relatively simple terminal systems, it furnishes the possibility for using the system description to predict the system's behaviour. That is, if one has the goal-seeking description of a system's behaviour, one has far more powerful means of predicting the system behaviour under conditions which are different from those existing in the previously conducted experiments.

Let us illustrate this by an example. An important feature of the development of both mass communications and scientific communications is that with the appearance of new media the old ones do not disappear but remain within the realm of human communication. As a rule, the older media, having relegated a part of their duties to the new media, begin a new life where they effectively perform more limited functions. This regularity derives from the fact that new communication needs do not eliminate the older needs which used to be satisfied by the already existing communication media. New communication media do not supersede but only complement the former ones, redistributing their functions.

The need for preservation and dissemination of knowledge which brought to life writing has not done away with the need for personal intercourse which is being met by oral speech; likewise the need for numerous identical copies of the same work, which led in the mid-15th century to Gutenberg's invention, has not eliminated the need for manuscript writing, scientific correspondence, and personal contacts among scientists. The appearance in 1665 and rapid progress of scientific journals has not made the book obsolete. Neither the cinema, nor radio or TV has ousted the book as a means for scientific and technical cognition of the world; quite the reverse is true: they have made its impact more effective and its use more widespread.

It can be argued with certainty on the strength of the foregoing evidence of the communication system as an hierarchically structured, stable, goal-seeking open system, that the forecasts occasionally made by certain authors to the effect that the book as we know it is going to be ousted by microforms, the library by information centres, and the natural language information by machine-readable data etc., are quite groundless.

Novel processes, methodologies and facilities of scientific and mass communications that appear continuously and are destined to improve the efficiency of mankind's intellectual activities will only complement and enrich the communication system and will not render the existing forms obsolescent. Communication media and techniques are very stable and conservative by virtue of being the embodiments of social consciousness, and their utilisation within a certain domain signifies the establishment of a stable communication channel between the members of a certain section of human society. The same reasons probably underlie the difficulties faced by any attempts to change systems of writing, alphabets, spelling, transcription and transliteration, special sign systems, etc.

Aspects of mechanisation - and particularly automation - of library-bibliographic and scientific-information operations have long become part and parcel of the librarianship and information work.

Nevertheless, one hesitates to say that everything goes well with this direction in the disciplines in question. The thing is that, all too often automation (or computerisation) is seen as just another, quite promising, line of activity of librarians and information specialists, as a means for stepping up the effectiveness of conventional information processing. In conformity with this view, established library science and informatics curricula are extended to incorporate small sections that present modern technical facilities (hardware) and their programming (software), describe new processes as well as operational or experimental automation and mechanisation projects involving isolated operations of libraries and information centres.

The reader of these sections in textbooks of library science and informatics is given the comfortable feeling that computers can be effectively applied without a complete reshuffling of all the existing practices. This is a totally false idea. John Diebold, an American automation expert, is quite right in saying that "Automation is more than a series of new machines and more basic than any particular hardware. It is a way of thinking as much as it is a way of doing. Automation is a new concept - the ideal of self-regulating systems - and a new set of principles ... But his kind of understanding is still so rare in policy-making levels as to be almost an isolated phenomenon" (9).

These lines were written nearly a decade ago, but the situation is still largely the same; the ultimate turn in the thinking of those responsible for planning and implementation of automation projects has not occurred as yet. With regard to library and information centre automation the situation is aggravated by an uncritical borrowing of the automation practices of industrial and computational applications without taking account of the special characteristics of these processes. Computer, programming and communication specialists do not approach the tasks of automating libraries and information centres with sufficient understanding of the fundamental objectives of these institutions and the tremendous problems posed by semantic information processing.

Meanwhile, the rapid progress in computer and other information technology breeds ever new automated information systems. Large libraries and scientific-information centres, having been equipped with third-generation computers and the necessary input/output devices, furnish the basis for integral information systems. They are built on the principle of one-time complete processing of a scientific information source by skilled professionals and one-time input of the processing product for future multiple use in dealing with a variety of library-bibliographic and scientific-information tasks.

Only by setting up and developing such systems can the existing scientific-communication system significantly improve its effectiveness, and scientific and technological progress maintain its present pace in the face of the quantitative growth of scientific information. The establishment of automated information systems and their regional, national, and international networks is one way of effectively furthering scientific and technological progress and advancing the world's science.

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HOW WILL NEW TECHNOLOGY CHANGE THE CHARACTERISTICS OF LIBRARIES AND THEIR USERS?

By Eugene Garfield

ABSTRACT

It is difficult to say in exactly what ways new technology will transform libraries in future years. Will anyone need libraries as we now know them if, as predicted, the general population will soon have on-line searching capability in their homes? What kinds of library services will be needed to acquire, store, retrieve, and disseminate materials stored on disks or through holographic methods? And what kinds of librarians will be best suited to manage the information centers of tomorrow, whatever form they may take? These and other questions are discussed. Although the outlook is generally optimistic, a realistic note of caution is also introduced.

There are today a plethora of technologies potentially useful to libraries, many in competition with each other. In the future we may use video cassettes, reel-to-reel video tape, or videodiscs to view films, plays, etc. We may routinely transmit and receive information via co-axial cable, telephone lines, microwaves, satellite, or all four means when appropriate. And our computers may use magnetic bubbles, optical memories, or holographic devices for storage. Which of these technologies will finally predominate is less important than the changes they will cause in the form and function of libraries.

Most librarians have ambivalent feelings about the coming changes. They can see many of the benefits to be derived such as speedier access, better control over a wider variety of materials, and less clerical work. But some aspects of the new technology are threatening. Familiar classification systems and search strategies may be rendered ineffective. So personal skills will need to be upgraded and the training of new library staff will become more complex. Acquisitions activities will require contact with an ever-widening group of suppliers. So a host of unfamiliar business practices will have to be learned. More importantly, new and diverse user groups from the information conscious society will require services previously unthought of. Imagination, flexibility, and ability to communicate will be even more important prerequisites for librarians than ever before (1).

To the extent that librarians are not willing to deal with the uncertainties of change, the benefits of new technologies will be difficult to obtain. For example, many large university libraries do not offer a computerized selective dissemination of information (SDI) service to their research communities (2). I'm sure one reason for this situation is a lack of support from librarians concerned about the ramifications of implementing such a service. Librarians worry that presently satisfied users may mistrust a computerized service. They fear the budget impact, increased requests for articles, and the hours which might be expended on profiling.

Not enough people have had the foresight and courage of Björn Tell who was instrumental in implementing the computerized SDI system at the Library of the Royal Institute of Technology in Stockholm. Björn knew that such a major undertaking needed programs to deal with the secondary problems that would arise. So he saw to it that the programs were implemented and modified as needed. It is no wonder, then, that he could eventually use these words when describing the effect of the SDI service on the library staff: "They are more and more concerned with meeting the user's need for information rather than books" (3).

Perhaps the most far-reaching of the information technologies on the horizon is interactive on-line searching systems which use ordinary home television sets - with minor modifications - as computer terminals. It is likely that within the next decade this type of service will be available to individual homes throughout Europe and North America.

Viewdata, a system of this type sponsored by the British Post Office, will undergo extensive public testing during the latter part of 1978. To use Viewdata, a subscriber dials a local telephone number. This ties his or her television set into a minicomputer in which pages of data are stored. The viewer "orders" a particular page (a still message) by pressing numerical keys on a key pad. The page selection process starts by keying one of ten broad subject choices. Then, one out of ten sub-sets of the first choice displayed is selected, and so on. One out of a million pages could be selected in this manner (4).

Information for page display is supplied by over 200 organizations. Viewers may choose to see sports scores, social services announcements, new headlines, even abstracts of recent articles on health, energy, environmental sciences (through ISI's SCITEL(TM) service). If a viewer sees an item of special interest on a SCITEL page, he or she may use the key pad to order a copy of the complete article from ISI's OATS(R) (Original Article Tear Sheet) service.

In Viewdata at even this early phase, it is possible to discern the great and varied potential for society of this type of on-line, interactive TV system. Among its possibilities are computer-assisted education at home, ready information on day-to-day living, and instant information about many specialized areas of interest. But with this kind of service in nearly every home and office, perhaps people will need a library less. This will happen only if the library community disdains to participate in it. In fact, academic, public, government, and industrial libraries could all become major suppliers of information to these systems. For instance, government libraries could prepare bibliographies of government publications for laymen on energy, nutrition, gardening, etc. with prices and ordering information. A public library might run listings of new titles received, and viewers, by using their key pads, could request that a book be reserved for them. A special service for shut-ins might be the mailing of requested books to their homes.

Through Viewdata-like systems, university libraries could also offer a variety of information services of special interest to the academic community. New articles retrieved through the university SDI services could be displayed in this way as could lists of required reading and syllabi for courses. Other services might be a schedule of university events, a list of special shows at university museums, library hours, etc. Students and faculty would merely consult strategically placed TV's - in libraries, dorms, and class buildings - for the information needed.

The next step in interactive video would be direct access to motion video on demand. However, the day when we can request with a key pad the screening of a film on our home TV is in the more distant future - due primarily to the costs of such a system. In the interim, libraries are already beginning to broadcast motion video programs. In fact, the libraries which are offering video services are receiving an enthusiastic public response (5).

In many cases, the library has only a television set and one of the video cassette recorders on the market. Programs of cultural or social significance are recorded and played later at various times in the library for public viewing. This service is a great convenience for those who would otherwise have missed the programs. It has also attracted people who have never been to a library before.

This simple video service is already raising questions of copyright infringement similar to those raised by the use of photocopiers in libraries. While the copyright question is unresolved, the majority of libraries will hesitate to use the available technology. However if the controversy can be amicably settled, libraries will be able to acquire vast collections of video cassettes. (Videodiscs and reel-to-reel tapes are another possibility, but since the cassette is the most advanced and convenient format, I will speak in terms of video cassettes)(6).Commercial suppliers will doubtless offer pre-recorded TV programs, motion pictures, ballets, plays, and concerts on video cassettes at relatively inexpensive prices. The public which is already accustomed to the video medium for entertainment and cultural programs is likely to accept and even demand video cassette collections.

This intense public interest will also create physical problems for libraries. Space must be found within the library for private and group viewing of cassettes. When homes have cassette players, too, decisions will have to be made on the circulation of cassettes. Public libraries with video cassette collections may also encounter the delicate problem of censorship.

Although many libraries now offer movies on 8 or 16 mm film, their collections are miniscule compared to video cassette collections of the future. Furthermore, their films are solely for home use and can be viewed only by borrowers who have the necessary projector and screen. Video cassettes, however, may be easily played right in the library. It is quite possible that some parents will consider certain movies inappropriate for viewing by minors. Even a library which limited its collection to films that won American academy awards (certainly mainstream movies) might meet with controversy over "Klute", "Midnight Cowboy", "Shampoo", and "Cries and Whispers". The threat of a community-wide scandal will probably suffice to stop some libraries from acquiring a collection of cassettes. Alternatively, libraries may wish to restrict their collections to cassettes suitable for family viewing or limit access to the collection to adults.

University libraries with collection of video cassettes will not have this particular problem, but they will have some uniquely their own. The mere existence of inexpensive cassettes of films, plays, and ballets will undoubtedly stimulate scholarship in these fields. But a collection for the purposes of scholarly research must be cataloged properly to be useful. Librarians will have to investigate this new area with the close co-operation of faculty members.

For example, a ballet could be cataloged by its title, dance company, leading dancers, the choreographer, the composer of the score, and perhaps several other ways I haven't considered. What would be the costs of a project of this kind? Similarly, do you catalog a film by the title, director, studio? By starring actors as well? By genre?

Film, in particular, will require new reference tools for scholars. I think it likely that film scholars may produce an index to film motifs and types, similar to the tools that already exist for folklorists. I can imagine someday that a student in a film library will sit at a terminal connected to a central computer, tap out the number of a type - scientist, for instance - and get a list of all the films in the data base which have scientist in their casts of characters. The student might then refine the search to American films between 1930 and 1939 which deal with scientists and receive that list. A tool like this would open the film library to non-film scholars - sociologists, historians, ethnic studies experts - so that they, too, might take advantage of the resources available for their own work.

An even more ambitious video project now underway in nearly 100 public and university libraries in the U.S. is the operation of a cable TV channel (7). In this system, video is transmitted via a co-axial cable to the subscriber homes in the locality. A cable TV channel may be a simple way to replay for the public in their homes important, nationally broadcast programming, but in most cases, the libraries have become involved in program production.

Operating a cable TV channel may not be the ordinary librarian's idea of his or her role. Producing a television program requires lighting and audio technicians, camera operators, a tape editor, and a director. For most librarians, these jobs are as familiar as those done by astronauts. However, workshops on video skills for librarians are already being held around the United States. Courses in video are available at some universities, and in a few years library science curricula will routinely offer classes on video in the library.

Cable TV channels operated by university libraries have a great potential for educating the public since they can broadcast the guest speakers and artists who appear on campus. In fact, a university channel could even tape classes for later viewing by students - if the faculty would agree. This possibility goes beyond the redefinition of the university library to a revision of the idea of the university itself. This is a threatening idea, especially to a faculty member who might fear an evaluation by students before they sign up for the course. I do not believe that broadcasting classes would do away with teacher-student interaction in the classroom. I do think TV classes could have this beneficial effect: a student with an interest in literature or biology, but without the time or talent for the course, could tune into classes, learn something of the subject without embarrassment or pressure, and become better educated as a result.

Once a library begins to tape its own programs, however, a new problem emerges: which tapes would be saved; which erased for other uses? Besides the library staff trained in video technology, will there have to be a tape archivist? What policy will determine the retention or erasure of a tape? At a university, will the tape archives be open to students? How will the tapes be catalogued? Is a single university retrieval system possible through which a student could locate books and articles, a tape of a special lecture given by an eminent scholar when he or she visited the campus, and several tapes of class sessions in which faculty members dealt with the subject?

The changes wrought by video will be substantial and far-reaching. However, there are other technological innovations - of less overall impact in terms of society at large - which will also cause or necessitate changes in libraries and patrons.

One of these - rapid transmission of full text copies of articles, etc. - is an outgrowth of current technologies. Computerized SDI systems and the availability of secondary information services on-line through computer centers like ESA-SDS, Lockheed, and SDC have brought bibliographic information about new publications to scientists' attention more quickly than ever before. This rapid retrieval of information has in turn sharpened users desire for quick document fulfillment. In response, groups of libraries working in close cooperation with each other have set up computerized union catalogs of their holdings. Thus the whereabouts of a needed document may be quickly ascertained, but getting a copy of it into the hands of the person who requested it still takes time.

Studies in transmitting TV images of microfilm have been discouraging because standard television equipment cannot reproduce the detail of most texts. However, digital transmission (transmittal by a code as in a teletype or on-line computer system) of a complete text is a more likely possibility. The message is in machine-readable language and thus does not deteriorate in transmission the way a picture of the text itself does. High density storage devices can record vast quantities of material in digital form. One system can record the entire Encyclopedia Britannica on ten square inches (8). Digital transmission of text from one library to another in an information network would seem to be the next step in the chain begun by computerized information retrieval services. This method is particularly attractive because the text can be printed out at the receiving end so that the user can read it from a sheet of paper instead of looking at it on a screen.

The transmission of documents already in print leads to yet another possibility: the completely electronic journal. After all, the main obstacle to the transmission system is the cost of preparing the text in machine-readable form. It is not impossible that a library subscription to a journal will one day buy microfiches of the texts of articles in a form compatible with electronic transmission.

The economic plight of journal publishers is well-known, and one plan for cost-cutting is an "editorial processing center", a facility any number of journals could share, in which texts could be prepared for photocomposition on a word-processing machine and also stored in a computer (9). If libraries and even individual subscribers could be connected to the computer, they could receive on their terminals the text of any desired article - in effect, they would be reading an electronic journal.

Of all the changes which I have discussed, this one is farthest in the future (10). The costs of changing the system and the opposition by those who have an interest in the status quo are great. Adequate payment arrangements for receiving an article also present a problem which will slow implementation of this publishing technique.

In 1945 Vannevar Bush in his classic article "As We May Think", described "Memex", a scholar's information desk which involved mechanized storage and retrieval of the information necessary for the individual's own use (11). Over 30 years later this "desk" has not been created, but the technology for it is at hand. Here it would seem is the system that will diminish the need for the librarian. But Bush did not suggest how the scholar would locate the information he or she deemed worthy of retention in the Memex.

Although science librarians of the future may have little face-to-face interaction with the patron, they will play an important role in the provision of information relevant to the user's needs. Bibliographies of articles retrieved through the SDI system for the patron may be transmitted electronically to the individual's Memex for scanning. In turn, the user can electronically notify the librarian of those texts he or she wishes to see so that the librarian can acquire and transmit those articles for storage in Memex.

Of course, the librarian in this description may not actually work in a library or information center and probably will not be called a librarian. The traditional titles and occupations in the field - in the face of current technology - are already splintering into a kaleidoscope of careers. Information professionals who work within a library system now may be called: data base managers, information managers, SDI co-ordinators. Others have left the library environment, but not the field, by founding their own businesses - as data base producers, information brokers, and freelance librarians. Another new area beginning to grow in terms of careers for information specialists is the education of users - certainly anyone with a Memex is going to need some training before using it.

While libraries and librarians will continue to exist, we will see the advent of the information technologists, consultants, and educators who will also serve the user. Instead of losing their jobs to machines, professionals will discover a broader choice of careers in the burgeoning information field.

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INFORMATION-SEARCHING AND LIBRARY USAGE IN HIGHER EDUCATION*

By Lars Höglund and Olle Persson

1. INTRODUCTION

Recently, attention has been drawn to the importance of user education and marketing within the field of I & D. For example, libraries have found unsatisfactory their lack of resources for even the most elementary "marketing" of their information services.

The need for marketing - or for information about information - co-exists with a widespread lack of knowledge of today's library and methods of information-searching. A basic knowledge of such matters should exist at an early stage of all higher education.

The student's capability in seeking out information is also a prerequisite to the achievement of the goals of the new higher education system, which stress, among other things, internationalisation, close links with research, critical thought, and problem orientation:

> *Higher education in general aims at preparing for independent assignments in which a given background of knowledge and capability to gather information is essential. Instruction should therefore provide skills, not only because these will be of direct and immediate use in professional life, but also because they will provide a preparedness to assimilate infor-*

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*This article is based upon an interim report from a project undertaken by the Royal Institute of Technology Library and the Information Research Group at the Dept of Sociology at Umeå University. (See: Höglund & Persson 1976b.)

> *mation concerning different phenomena . . . Practice in the individual gathering and processing can virtually be seen as a system of instruction . . . A precondition of information gathering is also study-training. Vital aspects of the above include the capacity to assimilate specialist literature of the type later to be encountered in working life.*
> *(U68 Högskolan p. 61.)*

Unfortunately, no particular action has hitherto been taken in order to ensure that students are given adequate knowledge of the techniques of information-searching, knowledge which is implicit in the above-mentioned goals.

Studies of professionally active academics within a broad range of fields show clear deficiencies in both knowledge of, and the using of facilities for information-searching. For example, technicians who are active within the field of research and development very seldom make use of reference material or bibliographies. Computer-stored documentation is used to an even lesser extent, even if there is a marked increase in this (Selander 1968, Höglund-Persson 1976a). Among teachers and researchers within the field of social science, there is a limited usage of such facilities. A manifest lack of knowledge of available facilities has also been observed (Persson-Höglund 1973).

Against this background, it must be feared that a knowledge of the techniques of information-searching and of library usage is more deficient among academics and students active within practical fields. The problem of meagre usage has received attention from libraries, and resulted in research, development programmes, and education programmes, all in order to improve the situation.

The efforts made hitherto have, however, often shown themselves to have only had a limited effect. The reasons for this fact are thought to be a deficient integration of library education and ordinary education. One of the conclusions drawn by researchers in this field in other countries is that the problem of meagre usage can scarcely be solved by the library or the librarians single-handed.

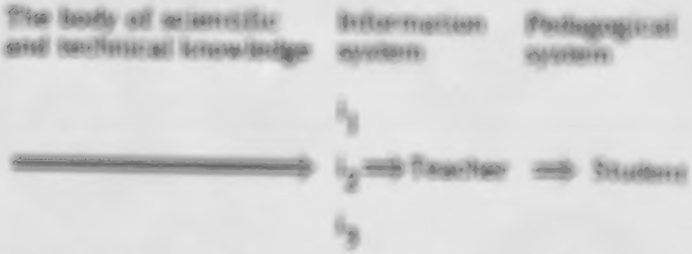
Other efforts have shown that significantly better results can be achieved if library education is linked with individual work and information-searching assignments within the framework of ordinary education (Lubans (1974).

3. INFORMATION-SEARCHING AND PEDAGOGY

The connection between the teaching method and information-searching can be illustrated by contrasting traditional and modern pedagogical methods. Traditional forms of teaching at university level can to a great extent be characterized by the fact that the student is presented with information.

The function of the teacher is to provide information, and it is the function of the student to receive it. Such a method of transferring knowledge becomes a one-way process, in which the teacher functions as the subject and the student as the object. This means that an integration of research and instruction can only occur through the teacher's contact with both instruction and research (Fig. 1).

Fig. 1 The transfer of knowledge by traditional pedagogical methods.



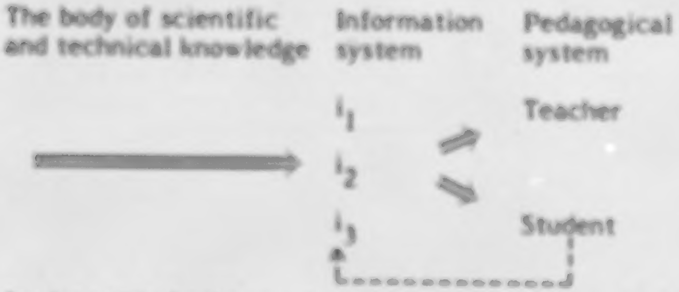
In recent years, there has been a forceful questioning of the traditional pedagogical philosophy. This occurs, for example, in the outline drawn up for the new higher education system, and also in that pertaining to other parts of the school system. New methods of instruction have been developed with greater emphasis placed on problem-orientation, project work and group work.

These modern pedagogical principles imply that the student himself has the possibility to seek out, process and evaluate critically information in order to solve or shed light upon problems. The teacher's function becomes more that of a tutor. It seems, however, as though the role of information-searching has been overlooked in this context. If the student lacks both knowledge of and motivation for seeking out knowledge, then he once again falls back on the teacher as the dominating source of knowledge. This situation is in direct contradiction to the basis upon which modern pedagogical methods are built.

In order to bring about a two-way communication between teacher and pupil, where the roles of transmitter and receiver are flexible, the student must be in a position to draw upon some source of knowledge as a basis for his active participation (Fig. 3).

The student's own experience can, of course, provide such a source. This fact is often emphasized as an important basis for modern pedagogical theory, but the importance of knowledge of specific subject areas is often overlooked. The risk with this situation is that in practice, the teacher and the laid-down course literature continue to dominate the body of available knowledge. In this case, a one-way system of information communication would again dominate – although in a different working form. Another risk coincides with the difficulty in pursuing effective information-searching connected with aspects of a course of short duration. Deficient knowledge of, and possibly deficient motivation for information-searching can thus result in a deficient exchange of knowledge and education.

Fig. 2 The transfer of knowledge by modern pedagogical methods.



Against this background, it is possible to regard independent information-searching as an important precondition to the existence of a well-functioning system of education according to modern pedagogical principals. That source which consists of the student's own experience could be strengthened by encouraging direct contact between the student and the supply of scientific knowledge. This is one of the reasons for our finding it important to analyse the conditions for independent information-searching, within the framework of higher education. Another reasons is that of further education, and a third reason is the matter of the growth of the body of knowledge, which creates successively more rigourous demands for knowledge and habits of successful information-searching.

3. A STUDY OF THE PRACTICE OF, AND ATTITUDES TOWARDS INFORMATION-SEARCHING AMONG TECHNOLOGY STUDENTS

On the initiative of the Royal Institute of Technology Library, a course in information-searching and library-use was given during Autumn term 1976 to a group of technology students. This course was organised in close association with the students' degree work, so that a close connection could be achieved between information-searching and the students' independent problem-solving under instruction. The group comprised 150 technologists in the penultimate term of their basic education, together with 30 doctoral candidates.

The results of a questionnaire survey completed by the group concerning knowledge of, attitudes to, and use of the library and its facilities for information-searching are presented below. The survey was conducted shortly before the beginning of the course. The results, therefore, give no information on the effects of the course, but are of general interest in that they reflect the extent to which technologists have mastered the techniques of information-searching immediately prior to their entry into professional life. The level of missing data was only 9% in the case of the technologists, and 40% in the case of the doctoral candidates.

4. RESULTS

A distinctive feature of the so-called traditional pedagogy. which dominates instruction at Swedish universities and institutes of higher education is that the student is often confronted with a body of course literature prior to the course starting. As a rule, this course literature is so comprehensive that the student's time is largely devoted to acquiring knowledge of it alone. The demands made on the prospective examinee are also in most cases concurrent with the extent to which he has assimilated the course literature.

This relationship means that visits to the library and information-searching may be expected to take a subordinate position in the student's scheme of priorities. This assumption is bourne out manifestly in the survey. (See Tables 1 and 2.)

Table 1

Do you feel that your using the library has any effect on your study results, apart from your degree examination and this revise?

Alternative replies	Total	Technologists	Doctoral candidates
	%	%	%
No effect	29	32	0
Very little effect	40	40	44
Little effect	22	21	28
Quite great effect	7	5	22
Very great effect	2	2	6
	100	100	100
(Base)	165	145	18

Table 2

Do you feel that the teachers at the Royal Inst. of Technology stimulate or encourage the searching for information or the using of the library?

Alternative replies	Total	Technologists	Doctoral candidates
	%	%	%
No, not at all	55	55	50
To a very little extent	31	33	29
To a little extent	12	10	29
To a rather great extent	1	1	0
To a very great extent	1	1	0
	100	100	100
(Base)	159	143	14

In Table 2 it may be seen that both technology students and doctoral candidates feel that their teachers only encourage information-searching and library usage to a very little extent, if at all. As many as 98% of the total felt this encouragement to be slight, very slight, or non-existent. Since the teachers themselves express no expectations or demands regarding information-searching or library usage, then it is not surprising that the students regard these activities as having little effect on study results. Table 2 may, therefore, be seen as an explanation of the statistics in Table 1.

If information-searching is regarded as less important in the matter of studies, then the situation is quite different when it comes to expectations of future professional activities. As many as 71% of the total felt that Information-searching and library usage would come to be of importance in their future professional activities to a rather great, or very great extent. Also in this question, the doctoral candidates gave a more positive result with 88% chosing the two highest alternatives, while the technologists undergoing basic education showed 69% in these two categories. (See Table 3.)

Table 3

Do you think that information-searching and library usage will be important to you in your future professional activities?

Alternative replies	Total %	Technologists %	Doctoral candidates %
No, not at all	2	1	0
To a very little extent	7	8	0
To a little extent	20	22	12
To a rather great extent	62	63	65
To a very great extent	9	6	23
	100	100	100
(Base)	163	144	17

The results presented hitherto show a contradiction in those demands made for information-searching during the period of study and those made by professional activity. During the period of study, one often works with given problems and given answers which differ from those problem-solving situations encountered in professional life.

How then are these prospective civil-engineers and Doctors of Technology equipped for meeting the demands which they themselves anticipate will be placed on them in their working lives regarding information-searching? In order to highlight this, questions were put in the survey concerning the use of, and knowledge of, a number of facilities for information-searching which are regarded as being important to have some knowledge of, at least.

For each of the ten different sources of information the question was asked whether the questionee knew of the source, and whether he himself had used it. Complex questions of computerized literature retrieval, various computor banks which are available in Sweden, etc., were not referred to at all, since the students in question would scarcely have had the opportunity to use such services. (See Table 4.)

Table 4

Knowledge of, and use of various facilities for information-searching. (Percentages above, base below)

	Total		Technologists		Doctoral candidates	
Facility	Know of	Have used	Know of	Have used	Know of	Have used
RIT Library Alphabetical Catalogue	65	47	62	43	89	78
	164	159	145	41	18	18
RIT Library Systematic Catalogue	53	30	51	27	71	59
	163	158	145	141	17	17
RIT Library Collection of handbooks & dictionaries	48	24	48	24	50	22
	162	158	143	140	18	18
RIT Library Notice-board announcing new books	27	11	25	10	44	22
	163	158	144	140	18	18
RIT Library Collection of course-literature	23	10	24	12	11	0
	161	158	142	139	18	18
Reference Index	15	6	12	4	41	24
	159	156	141	139	17	17
Engineering Index	4	3	2	1	17	11
	161	159	142	141	18	18
Science Citation Index	5	1	2	1	28	6
	161	158	142	140	18	18
Current contents	2	1	1	1	11	0
	161	158	142	141	18	18
RIT Library copying service	66	49	66	50	67	41
	162	158	143	141	18	17

Table 4 shows that the facilities that exist for finding the literature that exists in the library are relatively well-known - for example, the alphabetic and systematic catalogues. However, one must draw the conclusion that 70% of the study group had never used the RIT Library's systematic catalogue. Throughout Table 4, it may be seen that significantly fewer students used the facilities than knew about them. It may also be seen that the doctoral candidates show a greater knowledge of, and make greater use of the facilities than do the technologists. This points to the fact that the element of independent work included in doctoral education has led to a greater use being made of the library's facilities, even without the existence of special library courses.

The group as a whole, however, seems to make little use of the different index and reference facilities, indeed, they seem to have little knowledge of these. This is probably connected with the fact that these facilities have come into being during recent years, and that their utilisation often demand special help and training. That the utilisation of the index and reference facilities is so low, means that the student is initially referred to the somewhat older handbook-type sources. The chance of coming into contact with knowledge which is up-to-date and likely to encourage innovatory work, is therefore restricted by current information-searching practices.

The fact that so many students stated that they both knew of and used the RIT library's copying service, seems to be somewhat surprising. The copying service referred to in the questionnaire was that for the copying of articles from journals, etc. The question seems to have been misunderstood by many, whose answers refer, in all probability, to the copying machine in the lobby of the library, and which is often used for the copying of wholly different sorts of documentation.

It has been shown that the knowledge of, and use of sources of information is extremely limited, despite the fact that these are regarded as being important for future professional activities. We have earlier drawn attention to the role played by both teacher encouragement, and the students' assessment of the importance of using the library, as probable explanations of this situation. One important and self-evident precondition to knowledge of, and use of, these various facilities is that the student visits the library in the first place. Table 5 shows that approximately 70% of those questioned had either never visited, or had only seldom visited, the RIT library during the previous year.

Table 5

How often did you visit the RIT library during the last year in order to study, borrow material, or in search of information?

Number of visits	Total	Technologists	Doctoral candidates
	%	%	%
Have never visited the RIT library	42	36	15
Once or twice	30	28	40
2-3 times per term	20	18	20
4-6 times per term	5	4	15
1-3 times a month	8	8	10
One or more times a week	5	6	0
	100	100	100
(Base)	169	149	20

The most common reason given for not visiting the library, is that it is not felt necessary for the pursuit of studies, and that the course literature is so extensive that there is no time to read other material. Some also felt that they had not received adequate information concerning the library and its potential. A few also mentioned difficulties in locating material.

In answer to a direct question, 45% of those questioned felt that it was difficult, or quite difficult to locate the literature that one would wish. (Table 6). 32% felt that it was easy, or very easy, to find material, while 27% never attempted to find any literature.

Table 6

Do you think that it is easy or difficult to find the literature that you need?

Alternative replies	Total %	Technologists %	Doctoral candidates %
Very difficult	3	4	0
Rather difficult	42	39	65
Rather easy	31	31	29
Very easy	1	1	0
Have not looked	27	25	6
	100	100	100
(Base)	154	136	17

Table 7

Do you consider your knowledge of the library and of information-searching to be good or bad?

Alternative replies	Total	Technologists	Doctoral candidates
	%	%	%
Minimal	25	26	11
Rather bad	63	62	72
Rather good	10	10	17
Good	2	2	0
Very good	0	0	0
	100	100	100
(Base)	163	144	18

In a final question, students were asked to make an assessment of their knowledge of the library and information-searching. (See Table 7.) 88% felt themselves to have minimal or rather bad degrees of knowledge of these matters.

9. CONCLUSION

The results that we have presented in this article show that there exists no systematic training in information-searching within the framework of technical education. Because information-searching and library usage are neither encouraged nor rewarded within the education system, the possibilities are limited of turning out technicians who are likely to introduce innovations, or who are well-equiped to meet the demands of a rapidly increasing body of knowledge.

Within the formulation of current educational policy, both the need for developing qualifications and for "refresher courses" have been brought up as methods of coping with rapid social and technical developments. One way in which these needs may be satisfied would be for the student to be taught under his period of study to continually monitor developments in his field of competence.

We have found in this study that the great majority of students feel that there will be relatively heavy demands made upon them in the matter of information-searching in their future professional acitivities. In the larger industrial concerns, with special R & D units, these demands will be manifest in the form of a responsibility to monitor developments in certain specialist fields, technical journals, special I & D units which furnish literature, handle literature-searching needs, etc. To a certain extent one may assume that within such firms the possibility may exist to compensate for personal shortcomings in the matter of finding information.

In smaller and middle-sized firms, there is often a total lack of special R & D units and I & D facilities. The possibility of keeping in touch with scientific and technical developments in the world outside the firm rests almost entirely in the hands of the individual technicians capabilities, interest and capacity to exploit available information sources and facilities. Thus it is particularly important for these firms that knowledge of information-searching techniques be laid down as a part of basic education.

In order to improve the present situation, it is necessary not only to provide instruction in library use and information-searching, but also to alter the lay-out of the instruction as a whole. Of particular importance in this regard is that information-searching be both demanded and rewarded. Only when such a course lay-out exists can the demands of professional life regarding information-searching become more consistent with technological education.

Litteratur

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UNIVERSITY LIBRARIES IN NATIONAL CO-OPERATION

By Vibeke Ammundsen

By university libraries are meant libraries servicing universities and other institutes of higher education whether the libraries are part of the university administration or not. Scandinavian university libraries are open to the general public and have been so since about 1800. This opening up of university libraries was a European, and specially a German trend. The Royal Library in Copenhagen was thus opened to the general public in 1793.

In the 18th and 19th centuries several special libraries were founded. In Denmark according to a governmental report on state libraries (Betænkning vedrørende Statens Bibliotekstjeneste) dating as far back as 1927 some special libraries were given the rôle of national central libraries within their specific subject fields: technology, agriculture, etc. As they serve institutes of higher education they are also reckoned among university libraries.

A great number of laboratory and institute libraries were also established in the 20th century as a supplement to the main libraries, but they were not as open to the general public as the main libraries. Some irrational growth of laboratory and institute libraries has been the result, especially in the few cases where the university is served by a totally independent library.

Last but not least a number of industrial firms have established special libraries willing to co-operate with the state-owned libraries in their inter-library lending activities. Here Swedish industrial firms play a leading rôle.

1. DOCUMENTATION

A general feature in recent years are the documentation activities developed by university and other research libraries, first of all within the technological sector, which serves not only science, but also industry. The combination research library - documentation center has long traditions, especially in Denmark. Many libraries make heavy use of international data-banks by means of edp, and some (e.g. The central technological library of Denmark) have an intensive follow-up service for the procurement of documents. Also input to data-banks, local, or international, is often handled by research libraries.

2. PUBLIC LIBRARIES

Public libraries in Scandinavia have developed along a different line, mainly concentrating on activities in the cultural and sociological field, included documentation within the humanities. Some of them, specially in Sweden, also yield information and service within science and technology, and a recent Swedish report emphasises the public libraries' future rôle in this sphere; but as public libraries are mainly municipally financed their organizational problems are of a different kind and not considered in this paper. It should be pointed out, however, that interlibrary lending activities comprise university as well as public libraries, and that a narrow co-operation exists in various other fields.

3. NEEDS FOR CENTRALIZED PLANNING

Within research and university libraries it has long been felt, however, that there is a need for a more centralized organization in all Scandinavian countries. It is not user-friendly that so many large libraries have their private classification schemes, some follow the Anglo-American Cataloguing rules and some the Prussian rules; in some places lending facilities are good, in some poor; statistics are unreliable (they will probably always be so), library technology is in some places advanced but in other places less so, to say the least, and library research in applied fields very sporadic. The lack of standardization has especially been felt with the advent of edp, the computerized library.

Research libraries are considered an integrated part of scientific research, information and documentation. It is thus of the utmost importance that financial means for university and other research libraries are considered part of allocations to research and higher education, and are given the same high priority. Unfortunately this is not the case.

No wonder that the 1970'es have seen several reports concerned with the future of research libraries.

4. NORWAY

In Norway a report to government (Utvalg til å vurdere behovet for koordinering og effektivisering av den faglige og vitenskapelige biblioteks- og dokumentasjonstjeneste) resulted in the establishment of "Riksbibliotekstjenesten" (The national office for research and special libraries) in 1969 as an independant governmental organization with the responsibility of establishing a nation-wide library and documentation system. Riksbibliotekstjenesten has the central responsibility for co-ordinating library technology and cataloguing rules, for planning of new libraries and for co-ordination of acquisition policy in the various regions of Norway. It may also give its opinion on specific budgetary questions. Last, but not least bibliography and documentation is a primary interest of Riksbibliotekstjenesten. The responsibility for documentation was in 1970 delegated to a sub-committee called NORINDOK (Norsk Komité for Information og Dokumentation). The establishment of Riksbibliotekstjenesten was in effect a pioneer work in Scandinavia, and the full report deserves a closer study. Here are only mentioned a few main features.

5. FINLAND

Finland issued in 1975 "Omorganisation av Forskningsbibliotekens gemensamma arbetsuppgifter i Finland" (Re-organization of the work of Finnish research libraries). Also this report covers research libraries as well as information activities on a nation-wide basis. The report was made by the Council for scientific information, TINFO. The report recommends the establishment of a central unit, divided into three sectors, a planning and development sector, a bibliographical sector, and an archival sector. The planning sector will be responsible for standardization, classification systems, statistics, international co-operation, and the development of computerized systems. - The central unit should not have local responsibilities or cover special scientific fields. This is left to scientific central libraries. Also the Finnish report gives solutions to a wide range of problems.

6. DENMARK

In Denmark a special policy-making committee Målsætningsudvalg) was set up by the advisory research library council. This committee submitted a two-volume report in April 1977 (Forskningsbibliotekernes målsætning. Bd. 1-2, København 1977). The report recommends a new superstructure for research libraries, a common directorate under one ministry. The directorate should be a steering instrument in order to achieve a co-ordinated development and rational utilization of resources. The directorate should be assisted by a consultative council representing users in the broadest sense, and the libraries through their leaders, and the staff. The directorate should be responsible for common activities such as co-operative bibliographical work (union catalogues), a depository library, etc. It should be responsible for standardization, and library statistics. The directorate should act in an advisory capacity to non-governmental research libraries on matters of library buildings, technology, computerization, etc. It should moreover start, encourage and co-ordinate library research and development, prepare library legislation, be a center for international relations and assist individual libraries in international co-operation. The directorate should be allowed to comment on individual library budgets but not be responsible for allocations to any library.

A recent library committee started its work in 1977, and various other possibilities are foreseen.

1) That the directorate should have budgetary control over state libraries
2) that the directorate should be a common directorate for research and public libraries.

The last solution is not to be hoped for, as the newly established municipal autonomy in many fields hardly will allow much steering of public libraries from a state directorate. Besides - the relatively small lending population of university libraries with a specialized demand has not so much political appeal as the numerous public library customers, where budgets are concerned.

7. SWEDEN

The last Scandinavian report was issued in October 1977 in Stockholm, "Vetenskaplig och teknisk informationsförsörjning" (Communication of scientific and technical information) SOU 1977:71. The report recommends the establishment of a "delegation" for communication of scientific and technical information. The delegation will be given economic resources for planning and co-ordination, also for commitments in the international field, and for research, development and related education. The delegation shall see to the establishment of certain "responsibility libraries" (libraries with a national responsibility within a specific subject field, e.g. technology, agriculture).

The government will have to ask the advice of the delegation in all major and principal information policy matters, and the delegation shall be allowed to express itself on governmental budgets concerning the information field, but not on individual library budgets.

The report suggests that the delegation shall have three sectors:

1) research and development,
2) planning and co-ordination,
3) national service programmes.

This new delegation should be a substitute for two existing councils, Forskningsbiblioteksrådet (the research library council) established in 1965 under the department for education as a consultative council, and SINFDOK (the governmental council for scientific information and documentation) established in 1968 under the department for industry.

Like the other proposed or existing Scandinavian councils the Swedish council will also be strongly influenced by users.

8. CENTRALIZED - DECENTRALIZED?

The above summary of new developments in Scandinavia has only given some main trends and do not give justification to the full reports which cover many aspects. Common to the four Scandinavian plans for the future is the difficulty envisaged by the fact that most libraries are administrered by "their" universities, even those whose greatest customers are industry. The national steering possibilities thus have their limits, and in some instances the reports come close to the art of balancing upon the razor-edge.

The Norwegian "Riksbibliotekstjenesten" has influence on local budgets for special purposes without having any large budget of its own. Sweden has a highly decentralized university library system, and budgetary control is not envisaged. On the other hand large financial supports are foreseen for national efforts, administrered by the delegation.

Denmark has large libraries with their own budgets on the government budget, and even libraries integrated in universities have a more or less independant status. The possibility of central budgetary control is thus a reality in Denmark.

One special problem for planning is however the rôle of the laboratory library which will collect material for daily use and for on-going research projects, and may tend to increase in importance if the main library is not adequately provided. As the laboratory library seldom has sufficient interlibrary lending facilities it is of the utmost importance that the main library has an all-round collection of material for research and education, and that the acquisition policy foresees trends especially in interdisciplinary fields, so that a country does not have severe vacuums in scientific information. The problem does not present so large difficulties where the main library is part of the university so that the main library and the laboratory libraries can be considered an integrated whole. But for independant libraries serving universities there has to be invented a special local steering mechanism. The important thing, however, is that the main library and the laboratory libraries are under the same central steering unit, and do not belong to different ministries.

But is, after all, central budgetary control the solution to library problems? It must not be forgotten that libraries are service institutes, servicing research and higher education, plus the surrounding world, especially industry. Planning and budgetary control thus has to be closely related to the demands of the primary users of research libraries. It is interesting to see that all four Scandinavian countries in their plans for the future include user groups in the advisory councils for research library planning. Some countries have them already.

9. UNIVERSITY PLANNING - LIBRARY PLANNING

In this connection it should be remembered that library planning has to be closely related to university planning, but attempts at steering the university development in Scandinavia has met with many difficulties.

In an effort to "democratize" the university, admission to the university has been made easier, especially in Sweden where you are admitted to the university without examination. Recently you are not even admitted to any university, as the name university has been abolished as beeing too academic. In Sweden you now have high-schools. The free admission to the university has necessarily lowered the standard of teaching, at least at the beginners' level.

Also in Denmark it is the attitude of some leading politicians that good brains are rarely the result of heredity but of social surroundings. Everybody must have a chance, which is fair enough. This results however in perceptible levelling out of different kinds of education. The old universities in Denmark are still universities, but the new university centres tend to accumulate different educations on various levels, with consequences for the library. Here a close co-operation with the public library is needed. It is, however, to be remembered that the university library has a special rôle to play in book selection, and have specialists, research librarians and documentalists (chemists, mathematicians, etc.) specially engaged in literature selection and scientific documentation work.

These various trends, the autonomy of each university and the levelling out of differences between various types of education, makes it difficult to "steer" universities as well as university libraries. It is, however, beginning to be felt that some trends are transitory, and that the need for scientific research on a high level is of such importance to small countries, that the downward trend has to be stopped. Countries like Denmark without natural raw material have to produce know-how, which eventually can be exported.

Here, again, the user groups come in. The employer (a discriminating word to-day) wants candidates with specific knowledge suited to their future jobs. University planners have to take the ultimate users of their "products", the candidates, into account. The democratic trend where students and staff have got more influence on their own working conditions has in many ways been useful, but in some respects democracy has been "overplayed", giving university professors, who were selected according to strictly scientific criteria, too little "say" over the development. But as revolutionary movements usually go from one extreme to the other, and pendle back into an acceptable middleposition, this will certainly also happen within the educational field.

With this optimistic forecasting university libraries will have their rôle to play in the scientific community, catering for the specialist and for higher education, an ultimate goal which should not be forgotten. It is thus of importance that the "steering" of university libraries is closely related to the steering of research and higher education, with due regard to users outside the universities, especially to industry. That means that the ministry which is responsible for research and higher education should also have the main responsibility for research libraries.

10. DOES LIBRARY PLANNING DIFFER MUCH IN SCANDINAVIA?

The interesting difference between the Scandinavian plans is on one side an attempt to have a central budgetary control unit, and on the other side decentralized budgetary control, but a strong co-ordinating unit with large funds for central activities (Sweden). But the Swedish "delegation" can develop into a very powerful central instrument, not less powerful than a unit with central budgetary control. Probably in ten years' time the difference will be more of a formality than a reality if present plans are adopted. Common to all Scandinavian plans is an attempt at national co-ordinated library and information systems, making the best and most unified use of library technology in its widest sense, and further research and development within this important field. Last but not least, libraries should be more friendly to users who should be co-responsible in planning of library and documentation service.

Iceland has not been mentioned in this paper because Iceland's rôle within information and documentation is rather new. But surely co-ordinative efforts in future will comprise all nordic countries, with important contributions from Iceland.

For those who have studied the Swedish report, and who know Björn Tell's style of writing, it is evident that Björn has contributed vastly to the Swedish report. Björn's position in information and library planning in Sweden is well known, and as we in Scandinavia study each others' reports and try to utilize the best results from each other (with the freedom to reject what we do not like), Björn's contribution will certainly have its impact on policy-making for information in other Scandinavian countries.

THE INTRODUCTION OF COMPUTER INFORMATION SERVICES TO A FEDERAL UNIVERSITY

By Brian Vickery and Alina Vickery

1. BACKGROUND

The University of London is a federal organisation comprising over sixty colleges, medical schools and specialised institutes. Each participating institution has one or more libraries, which range in size from a few thousand volumes up to a quarter million, the total bookstock of the University being over 5 million. This includes the holdings of the central University library. These libraries provide services to 6,000 academic staff, 16,000 postgraduates and 26,000 undergraduates.

Departments teaching the same subjects will be found in many institutions - for example, there are 14 medical schools, and there are faculties of science in 13 colleges. In many subjects, therefore, potential demand for library and information services is dispersed throughout a number of institutions that are located in various parts of or even outside of London.

In 1969, the governing body of the University (Senate) set up a Committee on Library Resources, to investigate the situation and to explore the possibilities of increased co-ordination and co-operation between the libraries. The Committee reported in 1971, and made recommendations on many topics including union catalogues, the joint depository library, and centralized processing (1). They also recommended the establishment of a central information service (CIS) that would have access to computerised sources of information.

The University had been slow to develop an active interest in computer-based information services. A survey in 1969 identified eleven systems operating within the University, half of them created by small groups of academic staff. The most solidly established of these - still operational today - was the Rock Mechanics Information Service at Imperial College (2-3).

The Committee on Library Resources in 1971 noted the advantages of specialised services such as RMIS: direct control by subject specialists, immediacy of access by the sponsoring department, and speed of response. But they pointed [illegible] disadvantages: individual systems were increasingly burdensome for an academic department to operate (there were several examples of discontinued systems), they were generally incompatible, there was danger of duplication of effort within the University, and there was no co-ordination of related subject fields. The Committee did not suggest that all computer information service within the University should be centralised, but they urged the value of a central service able to deal with queries in all subject areas, rather than exclusive reliance on a series of small and possibly unrelated services specialising in limited fields. The CIS would provide an operational search service for any individual, department or library within the University; it would advise on the development of local information systems to ensure compatibility; and it would set up effective links with the producers and processors of computer-based information.

In 1971, the Committee on Library Resources envisaged that the CIS would "assemble and maintain" computerised stores of information, thinking of the acquisition of magnetic tapes for processing on University computers. The first central expenditure in this field was, in fact, to subscribe to MARC tapes. Monthly subject selections were extracted from these for several individual libraries, using programs developed at the computer centre of University College. The budget put forward for the proposed CIS was tentative, since the exact pattern of its work was unclear.

Under such circumstances, it was not unexpected that Senate moved only cautiously in the direction proposed. They considered it premature to provide funds for an operational system without further investigation, and were only prepared to authorise "preliminary research" into the development. By 1973, a Library Resources Co-ordinating Committee (LRCC, responsible to Senate) was in existence, and they set up a Sub-committee to consider the proposals for a CIS. The Sub-committee, in January 1974, recommended that LRCC should investigate the need for information systems within the University, including the following points:

(a) what is already being done in the University and how is it funded,

(b) the needs of users, both actual and potential,

(c) the best and most economical ways of providing for these needs, whether centrally or locally,

(d) various types of access - by individuals, departments or libraries,

(e) method of assessing the value of various services;

(f) the effect of computer-based services on the demands made on libraries.

The outcome of this recommendation was the appointment of a Senior Information Systems Officer (SISO), an Assistant Information Officer and an executive secretary. (Later, two further AIOs were recruited as temporary staff.) What follows is a personal account of developments during the period 1976-77, in which one author (AV) participated as SISO, and the other (BCV) as a member of the CIS Sub-committee.

2. CONTACTS WITH THE UNIVERSITY COMMUNITY

Direct contact with all the 48,000 staff and students of the University was, of course, not possible with the small resources of the investigation project. Various routes were used to interact with some representative members of the University. Visits were made by SISO to many individual librarians, and she also regularly attended the Advisory Board (ABOL) on which each library of the University has a representative. A circular letter announcing the existence of CIS was sent to each academic Board of Studies, and presentations were made to a number of these. At a later stage, a circular was sent to individual academic departments throughout the University. Several issues of a newsletter were distributed, through the University Bulletin, to all academic staff. Contacts were made with all the major computer centres in the University.

The response of academic staff and postgraduates to these contacts was usually interested, often enthusiastic. Librarians did not always react so positively. For example, in October 1975 the Chairman of LRCC invited all University institutions to participate in an evaluation study, if possible contributing both staff time and funds. Three months later SISO renewed the appeal at ABOL, noting that only 8 replies had been received. She reported: "Both in the information workshop at Senate House, and in demonstrations in departments, we are meeting an enthusiastic response from many academics (staff and postgraduates) to computer information services. This is leading some of them to make repeated use of the central service, even if they are working far from it. Some Heads of the Departments now consider an on-line service to be a research tool. Their general attitude is that if these services cannot be provided through libraries, they will themselves set them up. If such individual action develops, information services will not be equally available to all academics, and the result for the University will not be economic. Libraries will no longer be the focal point for reference services. A gap will develop between the librarians and the academic community." It cannot be said that this warning made much impression.

3. INFORMATION WORKSHOPS

The comments just quoted indicate other aspects of contact with the University community. By 1974, when SISO was appointed, it was already clear that the earlier concept of information service - by University processing of leased or purchased tapes - needed amendment. The number of data bases available in machine-readable form was much larger than in 1971. The University was interested in the whole field of knowledge, and would need access to all available data bases. An alternative mode of access was now possible - online through the major processors. So early in 1975, contracts were placed with Lockheed, System Development Corporation, and the European Space Agency, and arrangements were made to access the National Library of Medicine files.

The information workshop at Senate House (where the main University Library is situated) provided video terminals linked with printers, and audio-visual equipment. Demonstrations, training and search services were offered gratis to academic staff, postgraduates and librarians. Subsequently, by using a portable terminal, workshop facilities were also taken direct to libraries and academic departments within the University. This last service, the "travelling workshop", proved to be a most important form of contact with potential and actual users. During 1975-77, about 120 visits were made, reaching 27 institutions within the University.

Over a period of two years CIS produced a series of news sheets and information sheets aimed at potential users. More could perhaps have been done to ensure that all staff and postgraduates were aware of the service and what it could offer, but the promotion carried out was sufficient to generate as high a demand for the free experimental service as the small staff could satisfy. Early in 1977, charges for services were introduced, and to counteract the expected check to demand increased promotion was needed. However, uncertainty then developed as to the future of CIS, since LRCC put on record that it gave computer information service the lowest place in its list of priorities, and consequently there was little incentive to continue promotion.

Knowledge of CIS services spread a good deal by word of mouth, but from the first it was decided to introduce demonstrations of these services in the Senate House workshop and in other parts of the University. Even before receiving a grant for the travelling workshop, the CIS took equipment around colleges and institutes. The demonstrations consisted of lectures to staff and postgraduates on the subject of computer-based information services, and searches at the terminal, usually oriented towards the current needs of the audience. It was particularly important to familiarise them with the multidisciplinary character of the services, the variety of data bases offered, and the flexibility of search techniques. After the searches, discussion of the implications of introducing such services to the University was encouraged.

These visits were undoubtedly the most effective form of promotion. Attendance was very much dependent on how the visit had been arranged and advertised by the host institution. The best results were achieved where the head of an academic department had arranged for the demonstration. It seems that the staff and students of the department felt that he was behind the project, encouraging and supporting it. This usually brought the whole department together, resulting in a very vivid discussion of possibilities for the future.

6. TRAINING ACTIVITIES

Three forms of training were undertaken. One was a short course on computerised information services to academics all working in the same field, in this case to medical academic staff. Here we wanted to achieve some specialisation in the subject matter. The programme of the course included description of directly relevant data bases such as MEDLINE and those in related subject fields, e.g. BIOSIS. The use of on-line commands, the use of classification and of free language, an introduction to thesauri, hands-on experience of terminals, were all part of the course.

A second form of course was designed to give an understanding of computer information services to working librarians, not necessarily intending to be trained as intermediaries. Here we dealt with a population usually not knowing anything about computers, often starting with mixed feelings – fear of touching the terminals, even worried by the possibility of being replaced by a machine – and hence inclined to defend the existing methods of manual searching and their own acquaintance with library resources. The programme of demonstration to this group of people needed to display the co-operative function between man and machine, which functions are best performed by man and which by machine. We introduced them to the development of computer services, starting with the production of indexes (KWIC, KWOC), referring to the computer typesetting of abstracts journals and the creation of data bases. We illustrated the use of these data bases and made a comparison of manual and computer search.

Lastly there were courses specially aiming to train intermediaries for computer information search. We will have more to say about the role of the intermediary in the next section. These courses lasted at least three days and were carried out on two levels: for beginners and for more experienced staff. The course for beginners covered three stages (input, throughput and output) with practical work on indexing, abstracting, input of data to a local data base, discussion of operations performed by the computer (throughput), search strategies, use of thesauri, use of on-line services, main commands, hands-on use of the terminal, outputs on-line and off-line. The advanced course concentrated mainly on the interface between the user and the intermediary. The conversation with the user before the search, understanding his needs in various circumstances (e.g. beginning of a new project), the performance of complicated searches. The course for the beginners did not demand special subject knowledge, but the advanced course could be performed only for those information staff who had either a subject specialisation or good working experience as a reference librarian in the subject. Such courses were also presented to people outside the University (for a fee).

We see also the need for yet another type of course - for those concerned with the administration of the University and its institutions. Here need to be discussed the wider implications of the entry of computers and telecommunications into many phases of the information system. How far-reaching will their impact be? What effects will this have on information provision? How greatly will the conventional pattern of printed publications on library shelves be altered? What reallocation of resources may be necessary? The University needs to begin a study of such problems now, before they are upon us in force.

5. POTENTIAL DEMAND FOR SERVICES

How can one estimate the potential demand for computer information search within the University of London? A first discussion of this was presented in May 1975. The previous year, PA Management Consultants had undertaken a forecast for the European Community of the likely growth in demand for online and SDI computer search. Their figures for the London area of the UK in 1976 were as follows:

Potential users of these services:	250,000
Estimated online searches:	7,400
Estimated SDI profiles:	4,350

They predicted very rapid subsequent growth (e.g. 200,000 online searches in 1980). In 1975, there was only one piece of factual evidence to set against these forecasts. PA predicted 6,200 UK online searches in 1976 in medicine (including pharmacology and psychology), whereas the UK Medline service was, in 1975, already being used at the rate of 7,000 searches a year. This suggested that PA may have underestimated the demand for online search, and SISO considered that they had overestimated the continuing demand for batch SDI.

University academic staff and postgraduates, in the knowledge fields covered by the PA forecasts, totalled about 20,000 - say, 8% of the London area figure used by PA. Using this percentage, forecasts for University searches in 1976 could be as follows:

	Online	SDI
Based on PA forecasts	600	350
As amended by SISO	2,400	50

The amended forecasts proved reasonably accurate. During 1976, CIS catered for about 2,000 user sessions (equivalent to about 3,000 individual topics searched), and provided SDI profiles for 44 users. In both types of search, more could have been undertaken if resources had permitted.

The 1976 figures represented about 10 per cent of potential University use in the science, technology, medicine and social science faculties. PA forecast a thirty-fold increase in use between 1976 and 1980. It is therefore very likely that the University use of computer-based services - if able to develop freely - would at least reach the level of one online search per potential user per year, a possible total of 20,000 user sessions annually, and perhaps more. These would probably be carried out at about 25 service points within the University.

6. EVALUATION STUDIES

A plan of work drawn up in December 1974 envisaged a period of workshop demonstrations, training and pilot services up to mid-1977, followed by one year of formal feasibility study to determine the preferred pattern of operational service. However, by the autumn of 1975 it was clear that enthusiasm for services was growing, and that operational proposals should be presented earlier than 1978. Accordingly, plans were prepared for the collection of evaluation data throughout 1976, from which conclusions for the future might be drawn.

The evaluation concentrated on the use of online services for retrospective search, although data was also collected on SDI (both batch and online). For each online session, the following information was collected:

Location of session (whether at Senate House or at an institution visited by the travelling workshop)

Mode of request (visit, telephone, letter)

Background data on user: institutional origin, status, degree subject, methods of keeping up to date

Subject of search

Search formulation (by user, by information officer, or jointly)

Terminal operation (by user or intermediary)

Processors and data bases used

References recalled online (total, number relevant, number both relevant and new to user)

Offline prints ordered (subsequently assessed as to relevance and novelty)

Connect time for session

Cost of search (telecommunications, CPU and offline prints)

Subsequent assessments by users
    Number of recalled references read
    Where obtained (own institution's library, other University library, interlibrary loan)
    General comments.

A preliminary account of evaluation results was presented by SISO to a conference on the future role of computerised information services in the University of London, held in January 1977 (4). A final evaluation report has been published (5).

During the period February 1975 - November 1976 about 1800 members of the University population requested a retrospective online search. Some individuals used the service more than once, so the total number of user sessions was 2600. There was steadily increasing use by postgraduates, who accounted for 40% of the 1976 usage. The users came from about two-thirds of the 60 or so colleges and institutes of the University. The main subject fields represented were:

Medicine	17.7% of total sessions
Psychology	9.8
Biochemistry	7.0
Chemistry	6.6
Education	5.3
Zoology	4.7
Health service	3.9

Computer science	3.5
Physiology, anatomy	3.1
Pharmacy	3.0
Physics	3.0

The spread of use emphasised how important it is that future computer information services should be available, in one way or another, to users throughout the University, and eventually in all subject fields.

Over 90% of users expressed satisfaction with search results. At an average session of less than 20 minutes connect time, 16 references were recalled online, 9 of these relevant to the enquiry, and 6 of these were new to him. About 60% of users also ordered offline prints, on average receiving 60 references (32 relevant, 19 novel). During the evaluation period, the average total cost of such a session was about £15 (inclusive of connect time, telecommunications, offline prints, and information staff salary).

7. ROLE OF INTERMEDIARIES

The evaluation paid attention to the role of the information officer as a search intermediary. On first contact with such a system, the dream of the user is to have a terminal on his/her desk and to play with the system, to browse through data bases till saturation is achieved. This arises from two different reasons:

1. the curiosity of each human being to use a new toy; and
2. the fact that though a university worker has access to adequate library facilities, he does not encounter an active information service (unlike his industrial counterpart).

Until recently, the academic rarely obtained from his library service manual or computerised current awareness, or a retrospective literature search. Even when he delegated literature searching to a reference librarian perhaps the result was not too encouraging. For information search academic staff and postgraduates have had to depend on their own resources. Consequently, they may look forward to making personal use of computer information service. This viewpoint is sometimes reinforced by the experience of using a librarian (without the requisite subject knowledge) to construct search profiles for a commercial SDI service, with disappointing and sometimes traumatic results.

For effective and economic information search, whether SDI or retrospective, there needs to be a fusion of subject knowledge with an understanding of the system and the structure of the data base. We are not claiming that the enquirer cannot achieve this. But we are living in a world of very frequent technological change: search systems are continually developing, there is continual addition of new data bases which could be relevant to the user, new networks are coming into operation, each of which has its own selection of data bases at different prices and different time coverages. Playing with the system costs money, because the fee is directly related to connect time with the system.

In our experimental services - whether SDI or online search - in the majority of cases the user worked on the search together with a searcher/intermediary. The user provided subject-matter expertise and contributed to the refinement or redirection of the search strategy, and evaluated the search results. The participation of the user during a search has only one drawback - the search tends to last longer and therefore cost more, but the improved recall and precision that result make this worthwhile.

What qualities are needed in an intermediary? In our experience he or she

(1) should have a good first degree in a subject area broadly related to the subject of the enquirer - we have found that to cover searches in the natural and social sciences requires at least three separate subject backgrounds: physical, biomedical and social,

(2) should have a second qualification in library and information studies, so as to lay a firm foundation for understanding information services (whether computerised or not),

(3) should have special training in and experience of the use of computerised information systems and networks,

(4) should be devoted to giving professional service to a community of scholars.

The work of an intermediary is a highly professional task, demanding a keen interest in all the variety of subject enquiries for which a search strategy must be developed, and an intimate knowledge of the structure and vocabulary of each data base to be searched.

One might, of course, employ a terminal operator, who would dutifully, under dictation, type keywords and use command language on the terminal. To employ a qualified librarian in this way would certainly be a degradation of the profession. But it would also lead to ineffective search. To be an intermediary means to be a subject analyst, to acquire more and more knowledge the more searches one does; it is like going on an expedition into the unknown, into undiscovered areas with all the dangers of failure and frustration, and the joys of success. One newly trained intermediary, only a few days ago, said: "Now, I really feel like a professional librarian, even more than when I was serving at the reference desk."

If our conclusions are valid, then the introduction of computer information services into the library of an institution means more than buying a terminal and placing contracts with processors. The chief librarian must be prepared for the following tasks:

(1) to make available graduate librarians with degrees in those general subject areas in which service will be given, and to provide them with opportunities for detailed training in computer information search,

(2) to undertake demonstrations of the services for potential users, so as to fa[illegible]hem with the possibilities and with the modes of use that will achieve success,

(3) continually to monitor the interaction of users with the services, their satisfactions and their frustrations,

(4) to ensure that computer services develop in the closest relation with conventional library services, so that the most effective and economic use of total resources is achieved.

8. IMMEDIATE OUTCOME OF THE EVALUATION

The January 1977 conference discussed at length the pilot services and their evaluation, and came to the following conclusions:

(a) There is a need in the University for computerised information services.

(b) The decentralisation of the University clearly calls for some decentralisation of information services, but there remains a need for a central team to monitor, teach, and provide services for those institutions whose demand is not great enough to justify a local installation.

(c) Online services will form the central core of information services in the University, but there may be advantages in using in-house services for particular fields and particular types of user.

(d) A fuller understanding of the costs of a service is needed, but it is clearly necessary to seek ways of offsetting the costs, e.g. by selling services, in order to ensure that the smallest overall cost falls on users within the University.

(e) There is doubt as to whether individuals will be willing to pay the full costs of services, or indeed whether they should be expected to do so in view of the hidden benefits in terms of savings in staff time which can accrue from the use of computerised services. But at present the University does not have significant spare funds to put into a service, and it will be necessary to work out a balance of what can be paid for centrally, what costs the University can pick up, and the contributions likely to be made by individual Institutions. It is, however, important to avoid any wastage of the available services through their being insufficiently used as a result of a bad or too high costing system.

Having considered these, the Library Resources Co-ordinating Committee recommended to Senate that the CIS be continued as an operational service from August 1977, with the following functions:

(a) Centralised bulk purchase of equipment and contracting for access to data bases and telecommunications networks, in order to achieve the maximum economies offered by the agencies concerned to large users.

(b) Development of training methods and teaching aids, e.g. the Mediatron three-media teaching aid devised by the Senior Information Systems Officer.

(c) Training of intermediaries on the staffs of libraries or institutions wishing to start local services.

(d) Provision, as required, of demonstrations and workshops to introduce academic staff and students to information services.

(e) Monitoring the development of services and their use within the University and advice on their implications.

(f) Provision to University of information on new developments in information services, particularly those which can lead to economies in operation.

(g) Provision of guides to services and search aids for use within the University.

(h) Initiating investigations into problems relevant to the provision of services within the University.

(i) Provision of online search facilities for University institutions lacking local facilities, or for those whose local services cater only for a restricted range of subjects.

9. REALITIES OF THE SITUATION

The recommendations seem very encouraging. But for twelve months before the conference events had been shaping that would hold back their implementation. Like all British academic institutions, the University is suffering grave financial restrictions. Partly with this in mind, LRCC had in March 1976 asked Senate that a policy decision be taken as to whether an operational computer information service was to be free to members of the University - like conventional library services - or whether charges were to be made that should be paid either by individual users or by their institutions. Not surprisingly, Senate replied that any such service should aim to be self-supporting, and to date has only authorised the continued provision of a charged, but still experimental, CIS service. Central resources have in fact been reduced, for the two temporary Assistant Information Officers are no longer supported from University funds. On the other hand, local service points now exist at 11 colleges.

Although computer information service has been developing within this University for the last ten years, when the CIS was set up in 1974 such services were still a novelty to most University librarians, and indeed to most staff in computer centres. There can be no doubt that the work of CIS has introduced innovation and change into a previously stable and traditional model of the academic library.

These changes have not been introduced without conflict and clashes of interest, accentuated by the increasingly difficult economic situation. Librarians face many problems, and have many other areas of work competing for their attention and resources - such as the selection and preservation of library materials, "housekeeping" services such as cataloguing and circulation, the increasing demand for interlibrary loans and photocopies.

Academic librarians have always placed great emphasis on the organisation of library materials, the size and quality of the collection, but information search has nearly always been left to the end-user himself. Involvement in computer search requires an investment in staff time and equipment that may be hard to justify. Would the benefit justify the cost?

A trustworthy answer to this question has been difficult for the librarian to acquire, particularly in relation to online search. The technology has been novel - terminals, data communication with computer centres located on the other side of the globe, telecommunication agencies. It has been accompanied by a spawning of new jargon and many acronyms - data bases, logging in, connect time, DIALOG, SDC, EURONET.

The result has been that the introduction of computer information services has met with a considerable amount of misunderstanding and even hostility from many librarians within the University, and the future of Central Information Services is certainly unclear.

We think that a general conclusion can be drawn from this case history. Computers and telecommunications are beginning to cause far-reaching changes to the whole information system - primary publications, secondary publications, cataloguing and indexing, storage and retrieval. Economic and technological factors are indeed forcing through these changes at a pace that the academic library world finds difficult to assimilate. Yet we must adapt to these new developments. We therefore need the most active and continuous education of the library profession, at all levels - to cope with the problems that now face us.

Literature

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TO SAVE SPACE AND STAFF IN SWEDISH LIBRARIES[*]

By Uno Willers

I have worked at many different libraries, both in Sweden and abroad, but since the Royal Library in Stockholm is the one I know best it is only natural that most of my remarks will be based on conditions and practices there.

I believe that the majority of librarians would agree that our principal tasks are to take charge of the ever-increasing holdings, preserve them in the best possible way, and make it as easy as possible for research workers to find the best sources without unnecessary delay. Twenty years ago, when I had held the post as director of the Royal Library for less than four years, I wanted to illustrate these aims in a simple way, preferably by a quotation, for a large group of influential politicians. The title of my paper was, "With the library script as model". The words refer to one of the favourite books of my boyhood, Anatole France's well-known masterpiece "La Rôtisserie de la Reine Pédauque". The author had grown up in his father's second-hand bookshop and became an extremely learned bibliophil. As many of you will recall, the novel abounds in scholarly anecdotes and incidents. I am particularly fond of one of these and have referred to it so often that my friends have presented me with an ex-libris illustrating the episode. I will here quote the English translation (by Mrs Wilfrid Jackson) of this section of the book. It is M. d'Astarac who is telling the story to one of the other main characters in the book, Abbé Coignard:

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[*] Originally presented at the SCONUL conference in Cardiff Sept 1976.

"You are well aware that the Academy of Silos is rich in men of able minds. One of them, whose name is not known to you, who lived in the last century, was spending learned nights on an edition of Pindar. One night when he had worked desperately on five lines whose meaning he could not unravel, the text being very corrupt, he fell asleep despairingly at cock-crow. During his slumber a sylph, who loved him, transported him in spirit to Stockholm, introduced him into the palace of Queen Christina, led him to the library and drawing a manuscript of Pindar from one of the shelves opened it for him at the difficult passage. The five lines were there with two or three happy readings which made them quite intelligible.

In his excitement [sic] the learned man awoke, struck a light and immediately set down the lines in pencil as he remembered them. Thereupon he slept profoundly. The next day, reflecting upon his nocturnal adventure, he resolved to get light on it. Monsieur Descartes was in Sweden at the time, with the queen, to whom he was teaching his philosophy. Our Pindarist was acquainted with him, but he was on a more familiar footing with the King of Sweden's ambassador in France – one Monsieur Chanut. He addressed himself to the latter to forward a letter to Monsieur Descartes, in which he begged him to tell him if there was really a manuscript of Pindar in the queen's library at Stockholm containing the different reading he had indicated. Monsieur Descartes, who was extremely civil, replied to the academician of Silos that Her Majesty did in truth possess such a manuscript, and that he himself had read therein the lines with the different readings indicated in the letter."[9]

A library sylph who could appear to scholars in their dreams and lead them to the right sources would be an ideal form of library service. As it is, we must try to come as near as possible to this ideal in some other, more realistic way.

The first aim, of course, is to have the material that is borrowed often in one place. In Scandinavia, as in most other countries, libraries are faced with severe space problems, especially as regards storage space. We have tried several different remedies, in all cases following the example of our colleagues in Great Britain and on the Continent. When our well-known colleague, Julien Cain, visited the Royal Library in Stockholm for the first time in 1952 and heard that the books were arranged according to subject, he exclaimed: "Il faut des savants!" However, at that time we were already considering a change to a numerical arrangement, in order to save space. Most large libraries have now changed to some form of numerical arrangement, usually with three different format groups.

At the beginning of the fifties, the Head of the Riksdag Library, that is Sweden's Parliamentary Library, requested that the wing of the Parliament building used by the neighbouring National Bank of Sweden should be turned over to the Library for use as storage space. Other libraries had expressed similar needs and this request was the signal for Parliament to appoint a special commission. One of the results of its work was the erection of a depository library well outside Stockholm for the use of the Riksdag Library, the Royal Library and a number of other libraries in Stockholm and Uppsala. The building was completed in 1962 and is now used by no less than 30 different libraries for storing literature in low demand. A new wing was added a few years ago and the total capacity of this depository library is now 50 000 m. of book-shelves and space for 100 000 newspaper volumes. Communication between the staff, who live on the premises, and other libraries is maintained by means of telephone and telex, and a special van service for fetching and returning books and newspapers operates three times a week. The depository library is equipped with copying machines, reading room and reference literature and we have plans for further improvements, but at present lack the necessary funds.

In this connection, I should like to mention that interlibrary loans within the Stockholm area are facilitated by means of a daily van service. Approximately 40 libraries participate in this service, which is run by the Royal Library.

In the beginning of the fifties, I worked for a few years at the Swedish Ministry for Foreign Affairs as Head of a department of which the main archives was a section. This department was then about to move into new premises with very limited storage space. One day, one of my colleagues told me that he had recently read an article about a compact shelf system called "Store More" and manufactured in England. It was estimated that this system could reduce the storage space needed by up to 50 per cent. A specialist was sent over to England to study the system. which was eventually installed in the Archives of the Ministry. At about the same time we heard about the Swiss Ingold Compactus system. Both their automatic and manual systems are now manufactured in Sweden and have been installed in most modern or modernized libraries, from the university library of Uppsala and the Royal Library to small specialized libraries. The original initiative leading to the English design was taken by the great statesman Gladstone.

While on the subject of modern book-shelf design, I should like to mention an invention that has been made at the Royal Library. On the 8th May 1697, the Royal Palace in Stockholm was destroyed by fire and the collections of the Royal Library and of other cultural institutions housed in the Palace were badly damaged. We have not forgotten this tragic event in our history and have given much thought to the protection and, should the necessity arise, the safe removal of our most valuable material. We have, therefore, installed in our Rare Book and Manuscript repositories semi-automatic compact shelves where the stands are built up from easily demountable, portable sections, to which special lids can be fitted. An even better solution to this problem can be seen at Uppsala university library. When structural alterations were carried out there some years ago, a large shelter was added, with direct access from the main library.

It is also a question of economizing on reading room and office space, while still offering the best possible facilities to our visitors. One way in which we have been able to improve the service in our research reading room is by installing large storage cupboards and mobile bookshelves for approximately 200 regular readers. In practice this means that the 50 available tables can be used at different times by 200 readers. On the lower ground floor there is also a group of study rooms with its own entrance, which enables a number of research workers to come and go as they wish, even when the library is officially closed.

The use of pneumatic dispatch, walkie-talkie and telex has considerably reduced the waiting time for loan requests. Telex has proved particularly useful for ordering loans from the depository library north of Stockholm, since it can be used also when the request desk is not manned.

Additions and alterations to the Royal Library building have been made over the past years - and continue to be made - in order to meet new demands and changed conditions. One of our most difficult and interesting problems was that of finding an efficient method for conveying books within the library. I studied the problem personally in England, the United States and the Soviet Union, but finally found the solution in Western Germany: an automatic book conveyor system manufactured by Telelift in Munich. The installation of this conveyor system, which comprises tracks running to all floors of the building, was completed in 1974 and it has operated to our complete satisfaction.

The Swedish government's restrictive policy as regards staff increases for the research libraries has forced us to economize also in this respect. By means of TV monitors, it is now possible for one staff member to watch over four reading rooms. The shortage of staff in our long, narrow book repositories has to some extent been compensated by the use of walkie-talkie equipment and special tricycles.

An extensive computerized library system is at present under development in Sweden and several terminals are in operation at the Royal Library. As elsewhere, it is hoped that computer processing will relieve library staff of some of the time-consuming chores and result in systems design enabling us to give better service to our readers. So far, the illnesses of childhood have been more apparent than any time-saving properties, but we must look to the future.

The central administrative body for research libraries in Sweden has proposed that we should set up - on the British model - a central lending library for periodicals. However, the structural developments of the Swedish research library system at present seems to follow other directions, indicated in the report "Scientific and Technical Information Provision in Sweden - Proposal for new organization", submitted by two Swedish Government Commissions where Björn Tell and I have had a recent opportunity of close co-operation.

In 1956, when I wrote the original version of my essay about the library sylph I was completely unacquainted with computer technology and its potential role in libraries. Only through a lecture presented by Björn Tell at a conference one or two years later I realized that this new technology, used with ingenuity and wisdom, ought to be part of the sylph's range of proficiencies.

THE ROLE OF THE UPPSALA UNIVERSITY LIBRARY WITHIN THE NEW ORGANIZATION OF HIGHER EDUCATION

By Gert Hornwall

On July 1, 1977 the new organization of higher education (OHE) took effect and this has meant a radical remoulding of the Swedish university system. It has been justly said that this is the greatest university reform since the founding of our first university in the Middle Ages.

The new OHE is based on the principle that all undergraduate training should be looked upon as instruction embodied in the new unified concept of higher education. The instruction is divided into basic training and the training of future scholars. An important principle is that all basic training should also make it possible for students to go on to scholarly training through what is called "research connection". The training of scholars is organized along with research work which, in principle, should be carried out only at the universities.

The country has been divided into six regions of higher education. Each region has a university and should have as complete a spectrum as possible of basic courses. In each region, except that of Stockholm, there are several units of higher education (UHE). Some of the smaller units are linked to two neighbouring population centres. Besides Stockholm, the country thus has twenty permanent UHEs. Most educational forms in the OHE are governmental, but some of these new educational forms are administrated by primary municipalities or county councils.

The Uppsala region, which will be treated hereafter, is typical in that it contains both an old full-scale university and also several new UHEs and municipal centres of education. At Uppsala, the centre of the region, there is also a newly founded special university, the Swedish University of Agricultural Sciences. The region comprises the counties of Uppsala, Södermanland, Örebro, Västmanland, Kopparberg and Gävleborg, totalling a population of

1,600,000 inhabitants. Four new governmental UHEs have been organized within the region, namely the UHEs of Eskilstuna/Västerås, Falun/Borlänge, Gävle/Sandviken, and Örebro. Uppsala university offers training of scholars according to the old faculty division as well as basic higher education within the five different educational sections, i.e. for technical professions, for administrative, economic, and social professions, for nursing professions, for educational professions, and for cultural and information professions. In the new UHE the emphasis is on training within the sections of educational and nursing professions (the last-mentioned being municipal) but each UHE has also its special profile owing to the character of each reception area. The steel and engineering industry leaves its mark on the character of the courses at the UHE of Eskilstuna/Västerås, Falun/Borlänge, and Gävle/Sandviken. Special training for tourist service is being planned at the UHE of Falun/Borlänge. At the UHE of Örebro, which has been established through a fusion of the earlier university branch, the Graduate School for Social Work and Public Administration and the College of Physical Education (GIH), there is both a thorough social-science education and instructions for gymnastic masters.

The main task of the Uppsala university library is, as hitherto, to serve research work and teaching at the university. But in the new OHE it is also meant to function as the central library of the region and to try to cater for those book demands that are not satisfied by the proper resources of the new UHEs. To illustrate the problems that may turn up it might be instructive, by way of introduction, to describe the structure of one of these UHE, and that of Gävle/Sandviken has been chosen as an example. It was established as a result of strong local pressure through a parliamentary resolution and a special motion at the final stage of the preparations. The principal reception area of the UHE at Gävle/Sandviken is the county of Gävleborg which comprises the provinces of Gästrikland and Hälsingland with a population of altogether ca. 300,000 inhabitants. The density of population varies considerably from 54 inhabitants per sq.km. (the town of Gävle) to four inhabitants per sq.km. (the town of Ljusdal). The main centre of the region is the county town of Gävle in the province of Gästrikland, ranking number 14 of Swedish towns with 87,000 inhabitants. Gävle is an important industrial town with chiefly sulphate and sulphite mills, ceramic industry etc. As county town it has also been the centre of the cultural activities of the county with a rich variety of artistic and musical manifestations. 25 kilometres west of Gävle lies Sandviken with about 43,000 inhabitants, the main industry of which is the Sandvik Steel Works Co., manufacturers of high-quality products of iron, steel, and hard metal. Other important centres of the county are Hudiksvall (ca. 37,000 inhabitants), Söderhamn (ca. 32,000), and Bollnäs (ca. 28,000), all of them in the province of Hälsingland.

The state education of the Gävle/Sandviken UHE lies mainly within the sector of the teaching professions with more than 700 full-time students.

Of the four general lines of education the nursery-school teacher line (80 points) is the biggest with somewhat more than 500 students. The recreation leader line (80 points) has about 120 students and the intermediate stage teacher line (120 points) has about 100 students. (In the new OHE scheme, a "degree" can be constructed in a flexible way by combining different courses, whereby 20 points should correspond to one semester's work full-time.) In the junior school teacher line there is, as yet, no instruction but students will be admitted on this line in the autumn of 1978. The instruction within the general lines of education for the teaching professions is given exclusively at Gävle. Within the sector of technical professions there is a specialized course in steel industry at Sandviken (60 points) for 30 students, also under Government auspices. The state education also comprises a number of separate courses (most of them 10 points) for about 200 students in all. As a rule each course has 30 students. Courses in mathematics and environmental preservation have a technical specialization. Courses in physical culture and care of the healthy, child and youth psychology, and information about developing countries aim at an administrative, economic, and social specialization. Courses of a cultural and informative character are as follows: a course in cultural pedagogy and courses in English, music, ethnology, language in society, and man in family, profession and society. All students in these courses are part-time students. The county council education at Gävle comes within the sector of nursing professions. Training for nursing professions includes the instruction of nurses with two lines (the one 103 points, the other 60-65 points) as well as a social service line (60 points). Admission to these is gained upon proof of competency. One line (30 points) offers advanced training for nurses. A social service line (60 points) gives instruction for domestic helps and others. Altogether there are about 300 students who receive instruction through this training for nursing professions on the high school level. It is co-ordinated with education on the secondary school level for about 400 students. Finally, the primary municipal education comes within the sector of administrative, economic and social professions, including a general ADP-line (60 points) with 30 students.

Up till now the book supply for the UHE at Gävle has not caused any serious trouble. The training within the education sector is the result of a reorganization of the previous school of education, whose library is now at the disposal of the new UHE. The students who follow single courses have all been part-time students who have themselves bought the text-books they needed. The library of the school for nursing professions requires a considerable strengthening with regard to reference works and basic literature. As for the library's supplementary supply of books, it should rely primarily on the good medical library of the county hospital. Its further development should be catered for in the first place through local grants and in this respect the university library has chiefly an advisory function.

As far as the regional UHEs are concerned, the role of the university library is noticeable above all when it comes to the so-called "research connection". In principle, research work, in the proper sense of the word, is to be done exclusively at the universities. But even at the regional UHEs basic training should be given in such a way as to ensure "connection" with research and thereby open the way for those students who want to proceed with postgraduate studies. No basic training should prove a blind alley but should always make it possible to take up postgraduate studies. There have been no definite instructions as to how this research connection should be realized and the problems will, no doubt, be solved in different ways within different regions and at different UHEs within the same region, and, of course, also in various ways within different educational fields. In the preliminary discussion certain common elements have been stressed. Normally, teachers at the regional UHEs are not expected to do any research work by themselves. It is important, however, that they should be familiar with scholarly methods and structures within a particular field of research and that they should preferably have completed post-graduate studies. It has also been considered advisable that, for certain periods, they should have a chance to maintain direct contact with the research work that goes on within their particular subject area.

As regards the objectives for basic education, two main elements have been put in focus: on one hand fostering a certain preparedness towards knowledge, on the other hand an emphasis on instruction in methodology. The basic education within the UHEs has these two elements in common with the training of future scholars. The term "preparedness towards knowledge" is meant to imply a problem-oriented approach to knowledge. It is not merely a question of adding new elements of knowledge to old on an ever-increasing scale. Scientific outlook changes. What was once essential may be looked upon as contrary to later theories. Thus the problem is that antiquated theories and knowledge must be discarded. The instruction in methodology comprises a number of stages: to frame questions and pose problems, to seek suitable methods, to apply the methods chosen, and to present the result. This forms a necessary part of all higher education and should be included also in the basic education. It goes without saying that the introductory schooling in methodology must be of a more elementary kind than that of the postgraduate education. But it is essential that the students should be properly trained to pose problems and to solve them. For this purpose a large back-up of book resources, among other things, will be required in addition to what the UHE itself can offer, and this is where the contribution of the university libraries will be necessary.

The UHE of Gävle/Sandviken thus offers a comprehensive set of courses already in the first year. The connection with research at the UHE has been established by following-up of special research projects within the institutions of Uppsala university as well as at other places. Especially at a later stage considerable demands for inter-library loans service will be made on the university library in order that the necessary preparedness towards knowledge be achieved.

As for Swedish printed material the university library receives, since almost 300 years by special legal provision, complete annual book consignments from the printing offices. A report that has just been made recommends that this system, with certain adjustments, should be preserved but stresses the responsibility of the university library to place the literature that has been thus delivered at the disposal also of the other UHE within the region. This can be done in different ways. As far as the Uppsala region of higher education is concerned, it is probably most suitable to keep together within the university library practically all of the literature thus delivered to be placed at the disposal of the different UHEs through interlibrary circulation activities. It is, perhaps, conceivable that the main part of a special field, for example physical training and athletics, could be permanently located at the particular UHE (Örebro) which has the instruction of gymnastics masters on its programme. This, however, will be the subject of future consideration.

As regards the education at the UHE of Gävle/Sandviken, one may call attention to some fields where the need for interlibrary lending service will be particularly noticeable. One may thus take for granted that there will be a considerable demand for specialized fiction. Above all this is true of old and less familiar children's literature which arouses an ever increasing interest as a field of research. In the domain of literary history there has been developing in recent years a field of "sociology of literature" that will be of interest to the training of teachers while making special demands on research material. For the training of teachers of history and civics other fields of literature are of importance. Thus daily papers form a very significant material mirroring, as they do, the development of society with its changes and contrasts. Newspapers in original cannot be sent as interlibrary loans but the most important part of the Swedish daily press is available on 35 mm. microfilm which is easy to send and is readable by means of simple microfilm readers. The Swedish "smätryck", as it is called, offers a far more difficult problem. By this term, which is not so easy to define, is meant small printed matter which is not catalogued, brochures, annual reports, and other pamphlets of firms, parish pamphlets etc. This material is extremely important in order to render a full picture of Swedish society. But since it is not being catalogued it will be very difficult to place at people's disposal at other UHEs (i.e. outside the university library). In this respect reproduction and microfilm technique will play an important part, but questions of selection will be difficult to master. It may be expected that this very material of small printed matter will be of great importance to the other UHEs of the region which provide education to a great extent within the sector for administrative, economic, and social professions.

It is obvious that the library resources of Uppsala will be inadequate to certain forms of special training. The university library and the institutions at Uppsala will probably be able to satisfy the requirements of the school for nursing professions at Gävle. But the steel industry training at Sandviken, for example, is likely to have to rely directly on the Royal Institute of Technology Library in Stockholm for its supply of literature and information.

It will be an important task of the university library to supply the UHEs of the region with essential bibliographical information as regards both Swedish and foreign literature. In this respect central resources should also be made available. As soon as technical conditions are fulfilled, the different UREs should be linked up with the LIBRIS data network through their own terminals.

The central university library will probably have to assume the responsibility for informing the libraries of UREs about technical innovations and developments in the library field. Connected with this is the question of some form of training of the staff particularly within the category of library assistants. Probably, such training cannot be organised entirely within the framework of URE for libraries in fields. A regional organisation, partly according to previous practice, may prove suitable.

Thus the new URE will confront the Uppsala university library with a number of far-reaching questions, some of which difficult to master. The demands of the different UREs and their requirements on the library ought to be brought together and balanced against each other. According to the directives from the State authorities, the university library has an extensive responsibility for the supply of literature within the region, but the library staff will hardly be sufficient to fulfil this task in a satisfactory way. The university library ought to be assisted by a library board with representatives from the library units of the different UREs in the region. Such a board should also bring about a close co-operation with the central office of the Uppsala region of higher education. Thereby the total regional library resources may be co-ordinated and utilised in the best way in support of the education and research offered by all the UREs.

STUDENT ATTITUDES TO THE LIBRARY

By Elin Törnudd and Taina Koivula

Continuous surveillance of the attitudes, requirements and abilities of library users is a necessity especially in open access research libraries where information is needed for the development of library services and user education. In a library like Helsinki University of Technology Library which serves the students and staff of the university and functions at the same time as a national library for technology, the students form a high priority group, not least from the point of view of user training.

Since 1970 members of the library staff have carried out several surveys of the use made of the library by students, staff members and industrial clients. The methods used have been

- questionnaires mailed to the users and non-users,
- statistical analyses of requests for information retrieval and of reference questions,
- analyses of records of the loans department as well as the interlibrary service unit,
- interviewing users on the library premises,
- customer evaluation of references from SDI and online searches

Some survey reports are listed in the bibliography (1-5). Most of these surveys have given useful indications of the problems encountered, and efforts have been made to solve them.

That these improvements have not been sufficient, is shown by two surveys of student attitudes to the library carried out using the same method and sampling in 1973 and in 1977. These surveys were adaptations of the two surveys carried out by M.B. Line at the Southampton University Library (6-7). Our first study revealed the same deficiencies as the first British study, namely deficiencies of communication between the library staff and students, who did not appear to use the help library staff could give them. The second major problem was that the students neglected the use of reference material and catalogues of the library.

Several measures were taken to try to correct these deficiencies. Among these were

- the printed guides were simplified and redesigned
- sign-posts and mini-guides were hung in every part of the library
- the subject specialist duty desk was manned 7 hours a day
- the compulsory introduction to the use of the library to first year students was supplemented with a visit to the main library in groups of 25 students, who also were required to carry out a small exercise
- additional copies of textbooks needed by students were purchased
- the credit-giving courses in the use of information media and information services were increased from four courses a year to eight courses a year, which allowed closer focus to the students' subject specialty. These elective courses continuously attract about 20% of the student population
- organizing seminars about computer-based information retrieval to the university staff and the postgraduate students.

A further change which occurred, although not stemming from the survey, was a rise in the academic standing of the library staff. During the second survey, as a result of academic unemployment in the country, even junior library assistants, to a large degree, were graduates.

1. THE SECOND SURVEY

1.1 The method

The questionnaire used was the same as that for the first survey from which some questions were deleted. The query was sent to 321 students or every 17th student in the register of students arranged by the department of study.

This was a slightly smaller sample than that of the first study, which was addressed to 492 students, or every 11th student, in 1973. The response was 66%, a little weaker than for the first survey (70%).

The results of both surveys were processed by means of ADP-methods and the results were grouped by the year of study and by the subject of study.

1.2 Use of the library system

90% of the students reported that they used both the main library and their departmental library. No changes were to be found in this regard between the years 1973 and 1977 except that the use of libraries as places of study has increased 10%.

1.3 Use of the catalogues

As revealed by the summary table less than 2/3 of the students use the library catalogues as the first resort to find a certain book. Those who had passed the course in the use of information sources and information services apparently had become acquainted with the catalogues since 80% in this group use the catalogue as the first resort. Very few respondents found the use of the alphabetical author and title catalogue difficult. The same cannot be said about the subject catalogues based on the Universal Decimal Classification system. Here again students who have had the info-course had encountered less difficulties, only 1/4 considered its use difficult.

1.4 Methods used in subject searching of the library collections

Only half of the students had tried to find, what material there was in the library collections about a subject new to them. Here again the worst possible method, looking directly through the shelves was found to be the most common method used, as seen in the summary table. This in spite of the fact that the latest books usually are out on loan. Besides only books are shelved by subject, while serials including monograph series are shelved alphabetically in the periodicals section. Since even those who had passed the info-course resorted to the shelves rather than to the classified catalogues there is a strong case for considering a new shelving policy. Symposium series, special technical publications of various institutions and other serials should perhaps have to be scattered and shelved by subject. As revealed by figures in the summary table the use of the UDC-catalogue increases with the familiarity gained through instruction in the use of information sources.

From the year 1978 the card catalogue will be replaced by a COM-listing and it will be interesting to see whether this form will become more efficiently used than the card files.

Abstract and index publications are used very little in searching library material on a new subject; here again the info-course seems to have had a very beneficial effect as seen in the summary table. It should be added that there are no other means in the library to locate journal articles than using these secondary information media or using computer-based information retrieval.

Consultation of library staff has apparently increased a little while info-course"graduates" do not seem to need personal guidance to the same extent as the others.

1.5 Methods used for literature searches

Actual literature searches had been carried out among the respondents to both surveys by all students, in their third or later years of study as an exercise or in connection with thesis work. As revealed by the summary table very few changes, if any, seem to have occurred between 1973 and 1977, except that students who had passed the info-course to a greater extent resorted to the abstract and index journals and reference books. Both surveys showed that students in chemical engineering, mining and metallurgy and forest products differed from the students in civil engineering, surveying, architecture, mechanical engineering, applied physics and electrical engineering in that their first resort usually was an abstract or index publication (namely Chemical Abstracts).

1.6 Attitude towards library staff

As a rule the attitudes to staff members of the library are positive. 2/3 considered the staff members helpful while 1/3 of the respondents considered the staff members difficult to reach. 1/4 of the respondents hesitated to bother staff members because they either considered the question too rudimentary or the staff member seemed to be too busy to help. A slight improvement could be seen when comparing the results from 1973 and 1977.

1.7 The ability of the library to satisfy the requirements for literature by undergraduates

The main complaint expressed by respondents to both surveys was that the collections of required textbooks were not large enough. Complaints were equally frequent in the survey of 1973 and in the later one in spite of the fact, that the collections of textbooks in the meantime had been increased considerably.

2. CONCLUSION OF BOTH SURVEYS

The main conclusion of the two surveys is that surprisingly small changes have occurred between 1973 and 1977 in the attitudes of undergraduates, in spite of the fact that efforts had been made to make the library easier to use especially observing the deficiencies found in the earlier survey.

It is quite apparent that the instruction given to freshmen does not bring any other result than introducing the premises as a suitable place for study, in spite of the fact that all 900 freshmen tour the library in groups of moderate size with a qualified guide and that they carry out the compulsory excercise. At this stage of studies the motivation to learn more naturally is lacking.

The larger course in the use of information sources and information services given at a time when capabilities to search material from the collections and making literature searches covering the totality of scientific and technical literature are required in connection with the studying program, on the other hand, seem to be efficient. Efforts have been made to make these courses as practical as possible with exercises as the main requirement. 25 programs have been videotaped to enliven the lectures and tape-slide presentations have been introduced for the same purpose. In course evaluations the students have expressed their appreciation for the teaching methods (1).

The two surveys seem to recommend that these courses should be made obligatory to all students in engineering at their third or fourth year of study. Similarly increased efforts should be made to increase the interaction between students and the library staff in spite of the fact that shortage of staff becomes a more and more pressing problem. Library automation will have to release staff for increased guidance and consultation and it will also facilitate possible changes in the shelving policy.

The integrated automation of the library's acquisitions cataloguing and lending has been delayed, due to the economic situation in the country. It is to be hoped that when the plans finally can be materialized the attitudes to the university library and the abilities of its users to search information will improve at least among engineering students, who as is well known, prefer working at a terminal and searching in an interactive mode to looking up cards in a catalogue. In the meantime and in all the years to come students will have to be encouraged to resort to a greater extent to online information retrieval using information centers in different parts of the world, by subsidizing searches over the library's budget.

SUMMARY TABLE

Answers to the main questions by undergraduates in surveys I and II and by those undergraduates in survey II who had passed the course in the use of information sources and services, in %.

	Survey I 1973	Survey II 1977	Survey II respondents who passed info course
Use of card catalog as the first resort to find a certain book	62	60	80
Difficulty of use of the catalogs			
- alphabetical author and title cat.	7	6	-
- UDC-catalog	46	43	25
Methods used in searching library material on a subject			
- directly from the shelves	81	74	85
- using the UDC-catalog	64	67	79
- using abstract and index publications	36	28	61
- consulting a teacher	8	7	-
- consulting library staff	51	58	31
Selection of the first resort to make a literature search			
- references from a book or article	73	77	69
- journals suggested by the teacher	57	58	54
- reference books	40	55	62
- abstract and index publications	50	56	85
- consulting library staff	11	11	-
- other sources	12	10	7

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REFERENCE WORK DONE BY THE USER COMPARED WITH REFERENCE WORK DONE BY A DOCUMENTALIST. A USER STUDY AT THE NORWEGIAN INSTITUTE OF TECHNOLOGY

By Knut Thalberg

The library of the Norwegian Institute of Technology (NTHB) would like to present its services in a manner which gives the user the best possible assistance, and with that object in view a certain number of tests have been carried out. A combined documentation and users' examination was held thanks to a financial support from the Royal Norwegian Council for Scientific and Industrial Research (NTNF). Its purpose, among other things, was to find out whether a documentalist carries out reference work on a given subject better, as well as or maybe not as well as the client himself.

To avoid a technique mainly based on questionnaires, a special method was adopted. Ten consulting engineers (whom, from now on, we shall call the users) specialized in various technical fields, were engaged for a period of one week. Firms from various parts of this country, which did not belong to the usual circles using our library, were chosen.

During his one-week engagement at the Library, the user was to go through a special programme prepared in advance. Before coming to our library, he was expected to prepare a summary report on the way he and his colleagues usually search for technical information.

On his first day at the Library the user had to go through an introduction course in the use of library aids such as catalogues, bibliographies, abstracts publications and other reference material, SDI-services etc. From his usual work, the user brought with him two reference queries of actual interest.

On his second day, the user was given instruction in the use of abstracts and other manual aids of special importance for the solution of his two queries. The following two days the user was left to work on his queries. He was asked to use three hours and a half on one of his queries and seven hours on the other. This, in view to make possible a comparison between the list of references found by the user and the list which had been made out by one of the Library's documentalists who had used the same periods of time.

The rest of the 4th day as well as the 5th, were devoted to discussing the two lists of references and to the user's writing his final report concerning his views on how retrieval of technical information should be carried out by his firm in the light of the experience etc. he had gained during the week he had stayed at the NTHB.

According to plan, when the whole thing was over, we should have had two sets of 10 pairs of lists of references, one of the sets consisting of lists made out within three hours and a half, the other of lists made out within seven hours. Each pair consisted of one list made out by the user, the other by one of the documentalists at the NTHB.

Unfortunately things did not go quite that way. From one of the ten users we received no written statement and the answers to the reference queries from four of the others were not written in such a way as to permit their further use for a comparison with the lists of references made out by the documentalist. Our material for making an evaluation of whether a documentalist performs manual retrieval work on some definite subject better, as well as, or maybe not as well as the user himself, was thus reduced to two sets of five lists of references.

While the user has a thorough knowledge of what he is in quest of, he has only a superficial knowledge of abstracts and other reference aids, based on the special introduction into their use he received during his stay at the NTHB. The documentalist, on the other hand, is thoroughly familiar with the technical aids and abstracts available but can only get a superficial knowledge of what the user is actually in quest of, from the wording and the description given in the text of the query.

Query	Type	Relevance evaluation of consulting engineer's ref.					Number of references found by consulting engineer.	References found by both consulting engineer and documentalist.	Number of references found by documentalist	Relevance evaluation of documentalist's ref.				
		0	1	2	3	4				0	1	2	3	4
a	T	0	13	7	0	0	20	1	22	0	9	9	4	0
a	T	1	5	7	7	0	20	0	22	3	5	6	7	1
b	T	0	4	5	13	0	22	4	26	0	3	12	9	2
b	T	5	6	2	8	4	25	4	27	2	9	10	4	2
c	T	1	0	0	0	3	4	3	23	10	7	1	0	5
d	T	1	1	0	1	25	28	6	22	[illegible]	8	1	2	9
e	T	0	1	1	1	2	5	5	43	2	5	20	8	8
Average:		0,9	4,6	3,1	3,7	5,1	17,6	2,7	26,4	2,6	6,6	8,7	4,9	3,9
Average in %:		5,2	26,4	17,6	21,5	29,[illegible]	100		100	9,8	25	32,9	18,5	14,8
Corrected average:		0,6	3,6	5	2,6	2,2	12,2		20,2	1,6	4,6	8	5	3
Corrected average in %:		4,9	31,1	28,6	21,3	16	100		100	6,6	27,3	33	20,6	12,4
f	Tg	0	1	8	10	0	19	5	28*	1	8	10	7	[illegible]
f	Tg	0	7	7	6	1	20	5	23	8	3	16	1	3
g	Tg	1	1	3	1	0	6	0	11	0	5	3	3	0
g	Tg	1	1	1	3	0	6	0	10*	1	4	5	1	0
h	Tg	1	1	1	2	3	8	1	40	24	11	4	0	0
i	Tg	0	3	0	0	3	6	2	10	0	3	0	2	5
k	Tg	1	2	5	1	0	9	1	18	0	4	7	6	1
Average:		0,4	5,3	3,4	3	1	10,5	1,4	20,5	4	5,1	6,4	3,7	1,3
Average in %:		3,7	21,9	34,3	28,4	9,5	100		100	19,5	24,9	31,3	18	6,3
Corrected average:		0,4	1,4	3,8	2,8	0,8	8,8		11,2	0,4	2,6	4,2	3,4	0,6
Corrected average in %:		4,6	16,2	36,4	27,3	9,1	100		100	3,6	20,9	40,0	22,6	5,5

Table 1. Relevance evaluation of the consulting engineer's (user's) and documentalist's references for solving the queries, graded from 0 to 4 together with an average and corrected average of relevance evaluation.

Even though the time and technical aids used could be kept constant for user as well as for documentalist, there will still be a difference in the knowledge they have of the query and the technical aids, which will be the background of the inequality in the result. Out of consideration for the user's facilities EDP-methods were not employed.

The queries one had to deal with covered various fields and had different degrees of difficulty. The queries were about special conditions concerning the following topics:

- Smoke and pollution problems in the ferro-silicon industry.
- Influence of large-scale industry on the local community.
- Boiler cleaning. Shot cleaning.
- Road bridges with approach ramps.
- Telegraph - Switching.
- Psychology in traffic planning.
- Calcareous deposit in pipe lines, filters etc. in hot and warm water piping.
- Steam line piping for low pressure.
- Fish scrap.
- Remote control installation for oil/gas production platforms.

Of conclusive importance for the value of the results is the question of how relevant the various references are to the query. The only person capable of evaluating that, is the user himself. In order to counteract in some way the effects of too strong subjectivity in the evaluation, we sent out, first six months after the queries had been answered, one single alphabetical list of all the references found by both user and documentalist, submitting them to evaluation.

As relevancy grade to be used for each reference we suggested the following figures:

0 The reference is of no interest.
1 The reference is of some interest.
2 The reference is good.
3 The reference is of great interest.
4 The reference is right on the mark.

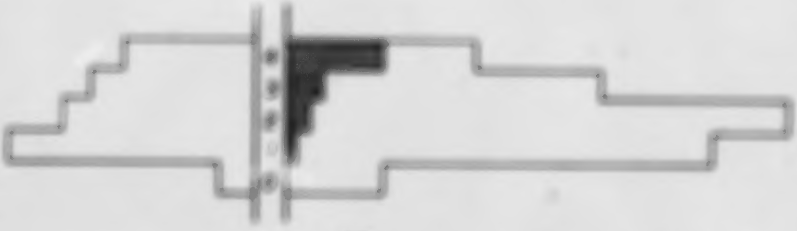
Moreover, we asked two of the firms to let two of their consulting engineers evaluate the relevancy of each reference. Thus, for a statistical estimate of relevance etc., we had now two sets of seven evaluations. In table 1 are given the results of that estimate.

For further elimination of subjectivity in relevance evaluation we shall in the following considerations use corrected averages whereby the highest and lowest figure in each column is no longer taken into account. It is quite obvious that our basis for a statistical estimate is weak. The number of sets of reference lists is small and the relevance evaluation is, after all, subjective. Nevertheless, I believe that the thoroughness with which we proceeded when making all the arrangements for a comparison and all the precious efforts done in connection with the searching for every single reference allow us, all reservations taken into consideration, to draw certain conclusions.

7 hours queries

Average number of references found by consulting engineer: 17.6

Average number of references found by documentation: 26.9



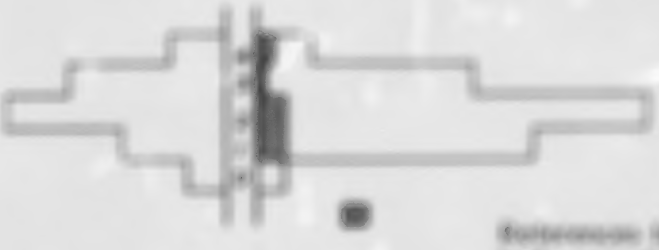
■ References found by both consulting engineer and documentation

Fig. 1 *Average relevancy distribution of references found within a period of 7 hours.*

3½ hours queries

Average number of references found by consulting engineer: 9,8

Average number of references found by documentalist: 13,8



References found by both consulting engineer and documentalist

Fig. 2 Average relevancy distribution of references found within a period of three hours and a half.

Figures 1 and 2 show a graphical representation of the relevancy distribution of the average number of references found by the user and the documentalist for both the 7 hours query (fig. 1) and the 3½ hours query (fig. 2).

Since one has graded relevancy from 1 to 9 it must be obvious that it is meaningful to have as many references as possible placed into group 9 or into the other laudable groups (8 and 7) and as few as possible into the inferior and worthless groups (1 and 2). Looking at the results obtained by the user and the documentalist in the 3½ hours and 7 hours tests we observe that the documentalist has found more references during the same period of time than the user. On an average abt. 40% more. This may partly be due to the fact that the documentalist is more familiar with bibliographical aids and methods than the user. On the other hand, it may also be due to the fact that the user, being a better judge of what he is in quest of during the search, is more discriminating in his evaluation of each reference and more inclined to discard irrelevant ones. If that is correct it should manifest itself in a higher percental distribution of the references found by the user in relevancy groups 3 and 4. Fig. 3 shows such a mean percental relevancy distribution and one observes that this is precisely the case. For both the 7 hours and the 3½ hours queries the percental distribution of the references in relevancy groups 3 and 4 are higher for the user's references than for the documentalist's.

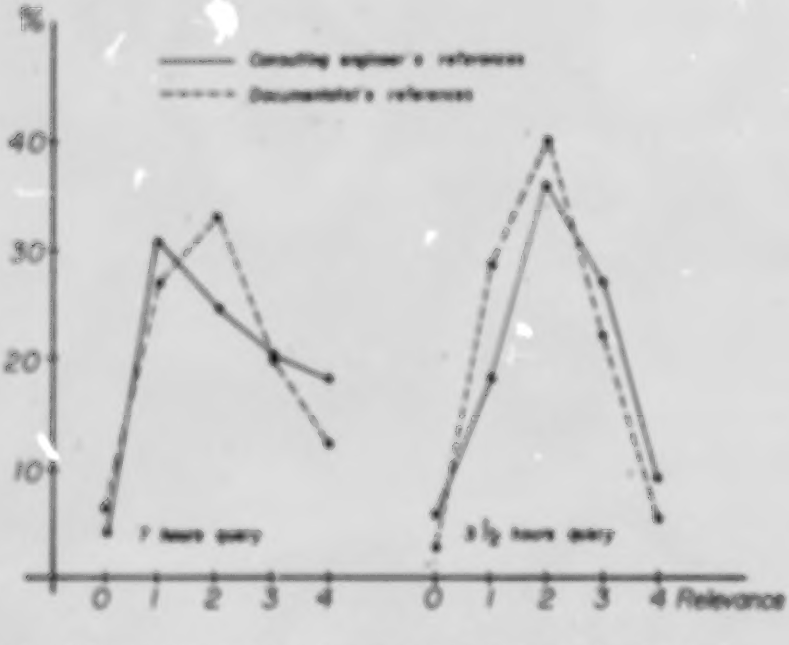


Fig. 3 Mean percental relevancy distribution of references. Comparison made between references found by consulting engineer and by documentalist.

In the light of this fact we must not forget that from a purely numerical point of view the documentalist found a larger number of references also in relevancy groups 3 and 4.

If only the user could be sure that all most relevant references he would find will also be found by the documentalist, everything would be all right and he could safely leave all searching for references to the documentalist. But that is not the case. On fig. 1 and 2 are drawn areas for references found by both user and documentalist. Fig. 2 shows that for the 3½ hours query the documentalist found a little less than the half of the references found by the user in relevancy group 4 and somewhat more than the half for the 7 hours query. In the other relevancy groups the documentalist found a lesser part of the references found by the user. This shows, as one could expect, that for the 7 hours query the documentalist found a higher percentage of the references found by the user than for the 3½ hours query.

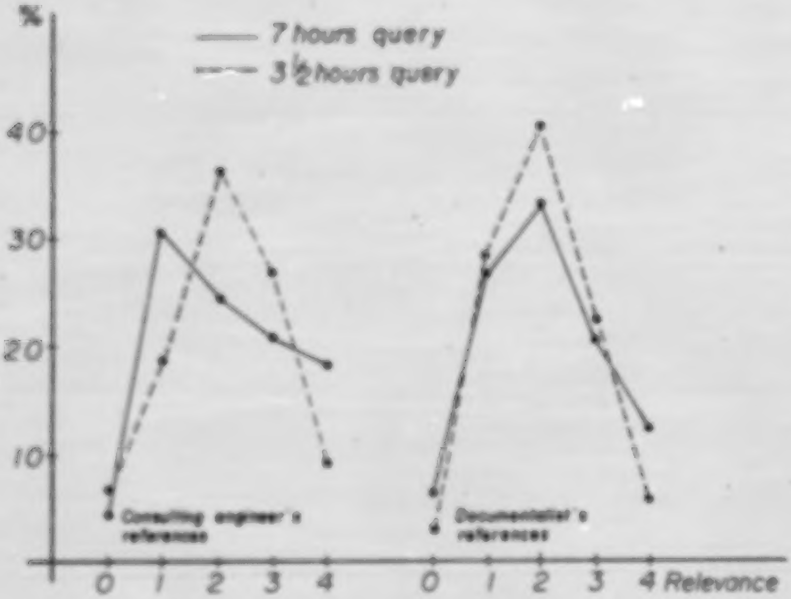


Fig. 4 Mean percental relevancy distribution of references. Comparison made between references found within a period of three hours and a half and within seven hours.

This points towards the probability that if we use more and more time for reference work, the major part of the references of topmost relevance found by the user, in all probability, will also be found by the documentalist who, moreover, will find more relevant references which the user will not succeed to find.

Fig. 4 shows that if we use more time, a higher percentage of the user's as well as the documentalist's references will be classified into relevancy group 4 to the detriment of their percentage in group 3 and especially in group 2.

This can be due to many factors but we have good reason to presume that as one works with the queries one gradually acquires a better insight into which references are of value and thus can make a better selection.

With all necessary reservations due to the scarcity of data and subjective relevance evaluation, in spite of corrections, I think we can summarize the following results:

- A documentalist is capable of finding more relevant references when answering a query than the user during the same period of time and with the same access to bibliographical aids such as abstracts publications etc.

- The user and the documentalist find different relevant references but the more time they spend on searching, the more of the user's references will also be found by the documentalist.

- Obviously the more time is spent on the search, the larger will be the number of references found, but at the same time the percentage of references of topmost relevance will increase.

These results manifested themselves also during the ensuing discussions which concluded the consulting engineer's stay at the NTHB, and one can assert that it would be in the best interests of the users to avail themselves of the documentalist's services for reference work provided that the queries are well defined.

THE FLOW OF BIBLIOGRAPHIC REFERENCES IN RESEARCH COMMUNICATION

By Folke Hermanson-Snickars

1. INTRODUCTION

One of the main components in the utilization and development of knowledge is the recording of knowledge in documents of different kinds (traditional publications as well as documents recorded on other media than paper, e.g. magnetic tapes, microfilm).

Their use is facilitated if all parties involved in the creation, distribution, conversion, storage and retrieval of the documents are aware of the interdependence between these processes and of the necessity for compatibility.

Knowledge may be recorded in many different ways. Inventories covering knowledgeable persons, collections of facts and data, reports and journal articles are examples of directly or indirectly documented knowledge.

Although a large number of studies show that direct communication between researchers is the most effective method for the transfer of information, reading still is of very high importance. The aim of this paper is to point out some areas of research communication which need a better understanding, and in some respects radical changes.

Most researchers are simultaneously readers and authors. The cumulation of knowledge is illustrated by the habit of citing items of the literature which has been used as background material. Writing a paper without citing work which has had an influence on the paper is not only against ethics, but also prevents readers from checking if the results of others have been properly used or interpreted.

In this paper, the two roles of a researcher will be described separately in order to illustrate the flow of bibliographic references connected with reading as well as with writing. As researchers usually are not readers only or authors only, this separation has to be regarded only as an attempt to give a better presentation of the issue.

2. THE RESEARCHER AS A READER

Formal communication channels, as journals, reports etc. still play an important part in most research areas. Every field of research has its core journals which are continuously read.

In additions there is a large number of possibilities of arranging a current awareness facility, either by subscribing to some secondary publications/services, or by some internal reference service.

There are also possibilities of making specific searches within subjects of immediate interest, either by using traditional tools in a library, or computer-based search services (1).

Use of the different existing reference services immediately raises the question of document delivery. Most libraries are faced with an increasing demand for providing documents announced by the reference services. These requests may, or may not, lead to reading of the actual documents. The desirable coincidence between a query and the content of a document cannot be judged without access to the document (Figure 1).

Actual reading of a document will initiate further requests for document delivery. Use of cited documents as keys to further studies is a well-known method of increasing one's knowledge.

The ability of a library to locate and deliver requested documents depends on many factors. It needs useful tools for location searches, catalogues covering its own collection as well as union catalogues. It even needs tools for verifying bibliographic data provided by optimistic, careless, or absent-minded users. These verification tools could be bibliographies, catalogues, etc., but also the source from which the request emanated.

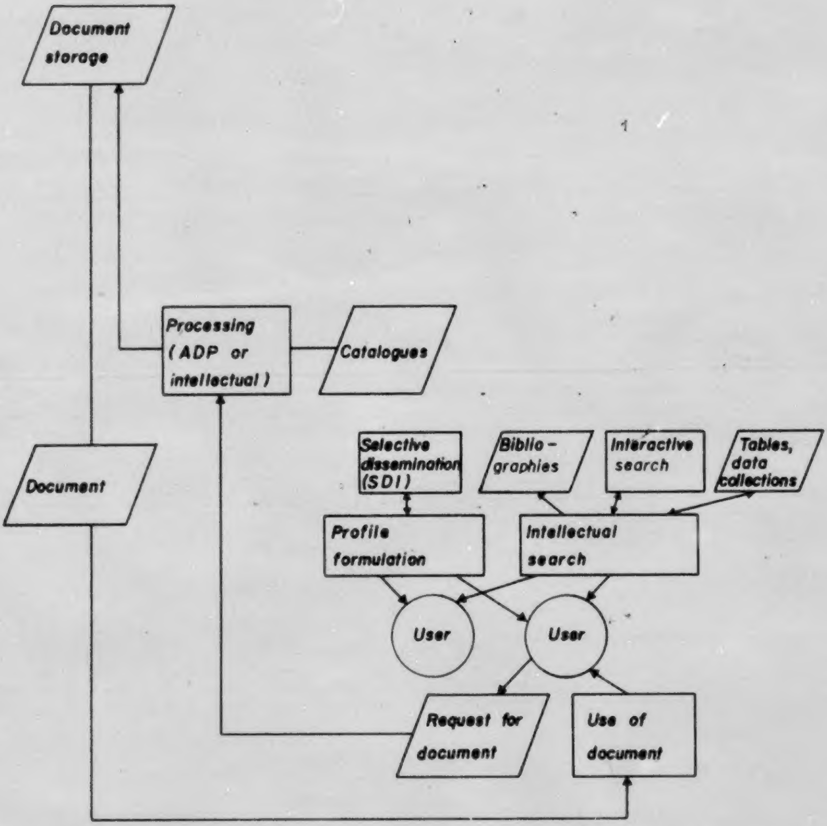

Document storage
Processing (ADP or intellectual)
Catalogues
Document
Selective dissemination (SDI)
Biblio-graphies
Interactive search
Tables, data collections
Profile formulation
Intellectual search
User
User
Request for document
Use of document

Fig I Reference services and document delivery

3. THE RESEARCHER AS AN AUTHOR

Research work contains a never-ending documentation activity. Project proposals, planning documents, and reports are mostly internal documents, not widely circulated. For many reasons, the publishing of research results is also a regular part of the work.

The documentary (bibliographic) data which each new document creates are of two kinds: references to cited documents, and presentation of data identifying the document itself.

An author wanting to cite or refer to contributions by other authors uses some citation system within his own contribution, either by listing cited contributions in a reference list and connecting the references with the text using numerical reference, or a short-form identifying the contribution (known as the Harvard system).

The reference must at least contain data necessary to uniquely identify the contribution. For identification purposes only, it could sometimes be sufficient to use a unique identification code, e.g. the code proposed in a UNISIST-ICSU/AB-document (2).

To give the reader some guidance on the content of and the intellectual responsibility for the cited document, it is preferable to give additional data. Such redundancy will also reduce the risk of problems in providing the document. Sometimes it is impossible for the author to know to what extent the data are necessary for identification, e.g. contributions in journals with no ISSN.

Often redundancy is justified also by the reason that tools for location (library catalogues, etc.) are not adapted to the practice used for the presentation of references or vice versa. Journal editors often have instructions how to present references, and also a relatively fixed form for presenting the title of an article, the name of the author, pagination, issue and volume designations, etc. Attempts to standardize bibliographic references as well as bibliographic identification (biblid) data are under way (3, 4, 5).

4. DOCUMENTARY DATA FOR REFERENCE, LOCATION AND DELIVERY

Publications containing reports on research are covered by many different abstracting & indexing organizations and institutions. Depending on content and quality of the document, it could be selected for inclusion in a secondary publication/service.

Data on the document will therefore be transferred not only to those reading the publication containing the article. Many will be informed of its existence by different secondary services.

Bibliographic agencies througout the world try to collect and describe as completely as possible the total output of printed publications and other documents. This bibliographic description is not primarily oriented towards the user of reference services, but towards the builders of library collections. The selection will not be based on content and quality, but rather on formal attributes.

Documentary data recorded by secondary services and bibliographic agencies represent a number of concepts dealing with the originator of the document, the publication (source) in which it is published, as well as the content of the document. Different data elements could be used for a number of purposes: identification, reference, description, classification, and indexing (Figure 2).

Documentary data are used not only for providing reference services, but also for establishing library catalogues (Figure 3). Data, however, are not represented in the same way due to conflicting description standards, traditions, and organizational patterns (6, 7, 8).

Some of the differences in description standards are justified by their specific application area. Other differences only tread the beaten track.

Some examples of the former type of differences should be given.

	Originator	Source	Content
Identification	Personal identity number	Codes eg ISSN	
Reference	Author name	Title of publication, serial	Title of document, article
Description	Author biogra[illegible]	Bibliographic description	Subject description eg abstracts
Classification	Type of originator eg editor, translator, author	Type of publication eg monography, serial, patent	Subject class eg UDC
Indexing	Author surname	Journal title abbreviation	Subject descriptors
Example of use	Biography	Bibliography	Subject analyses

Fig. 2 Documentary data

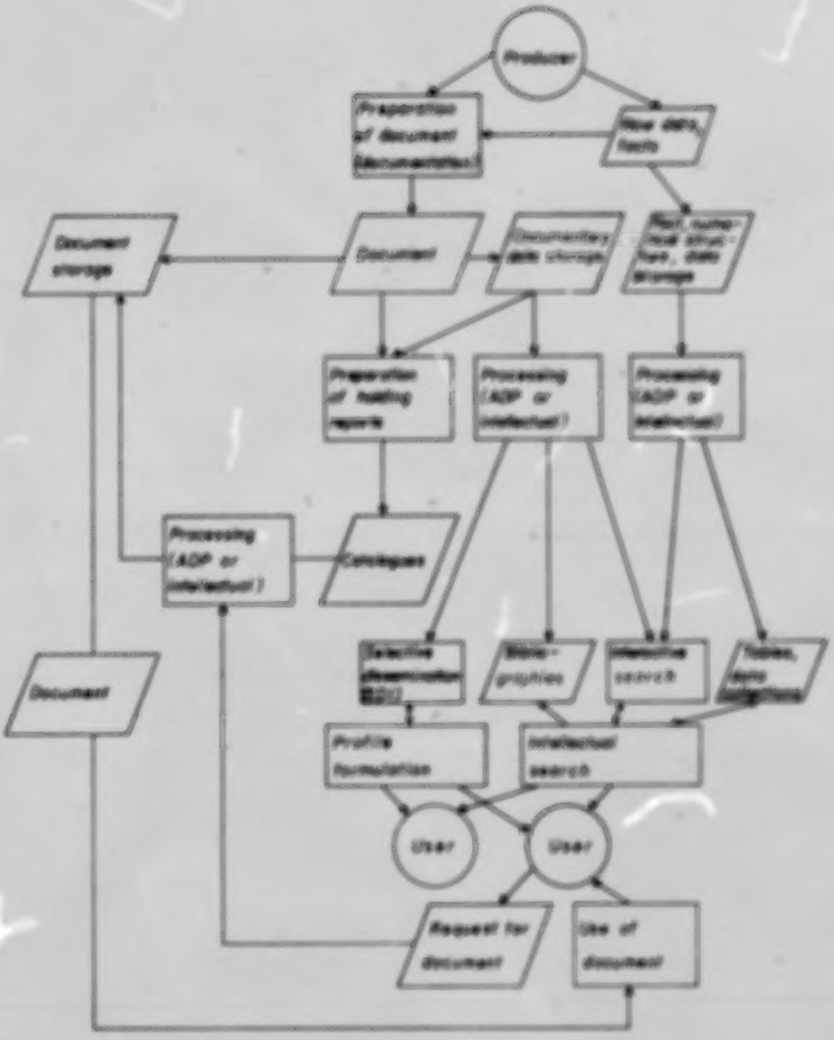

Producer
Preparation of document (documentation)
Raw data, facts
Document storage
Document
Documentary data storage
Raw, numerical structure, data storage
Preparation of holding reports
Processing (ADP or intellectual)
Processing (ADP or intellectual)
Processing (ADP or intellectual)
Catalogues
Selective dissemination (SDI)
Biblio-graphies
Interactive search
Tables, data compilations
Document
Profile formulation
Intellectual search
User
User
Request for document
Use of document

Fig 3 Documentary data used for reference services and document collections

A combination of data elements may be sufficient for the identification of a document. The same data elements used separately in other contexts may be too unspecific. E.g., it would be sufficient for identification to use the abbreviated journal title "Journal of applied chemistry" together with the volume number, title of article, author surname with initials etc. Librarians would certainly retrieve the right document, even if they have to consult two or more serials with the title beginning with the words "Journal of applied chemistry".

Including data elements in files, whether they are sorted catalogue cards, printed indexes, or computer-stored index files, presents needs for the inclusion of discriminating data in order to uniquely identify the entries. The larger the files, the greater the necessity for discrimination. E.g., most author surnames are not sufficiently discriminating, nor are surname and initials. Even if Christian names are added, additional data may be necessary. Even the date of birth could be the same for two persons with the same name. In functions where identity is of the highest importance, unique personal numbers are used, e.g. the Swedish personal identity number with the format YYMMDD-XXXC where

YY = 2 last digits of the year of birth
MM = 2 digits representing the month of birth
DD = 2 digits representing the day of birth
XXX = unique number for individuals born YY-MM-DD
C = check-digit

Similar examples could be found for other data elements. They all indicate difficulties met with when looking for better compatibility.

5. SUMMARY AND CONCLUSIONS

Researchers are in the same person readers as well as writers. They use the cumulated knowledge recorded in the literature, and they produce documents containing (hopefully) new knowledge. The bridge between the researcher and the literature is the bibliographic reference. A request to a library for a specific item is based on bibliographic data either come across in reading, or emanating from specific reference services, searches etc. Verification of bibliographic data is often necessary in libraries to locate the item in a library collection. Items not available in the local library collection are requested from other libraries using a union catalogue and a message system for transmission of requests for loans or copies between libraries.

Writing a new document, the researcher cites other documents which have been of value for the study in question. Doing so, he hopes that readers will be able to find the document cited, i.e., he gives links to the existent literature. His own contribution will be selected and referenced by institutions preparing bibliographies or other reference tools, such as abstract journals, index publications, etc.

Differences in description standards between abstracting and indexing institutions, on one side, and bibliographic agencies and libraries, on the other side, are causing low total efficiency in service to users of reference services and libraries. They are also causing inefficient procedures in library housekeeping, which indirectly influence the possibility for libraries to provide satisfactory services. One tendency illustrating this lack of service is the development of document delivery services offered by US reference services in combination with computer-based searches.

A development towards better performance is foreseen if the abstracting and indexing community, the library community, and the researchers themselves as producers of input to the other two realize the common interest to seek common documentary data elements to identify and describe documents. It is suggested that standardization activities should be concentrated to those data elements most frequently used in research communication.

6. ACKNOWLEDGEMENTS

I am grateful for many fruitful discussions with Gunnar Sundblad at the Standardiseringskommissionen i Sverige and Anders Martinsson at the University of Uppsala, who have both shared with me their great experience from fields not familiar to me.

Mr Göran Ekroth has kindly revised my English, and Ms Harriet Bergström typed the countless drafts of this paper.

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BIBLIOGRAPHY AS BIOGRAPHY

By Ola Palmaer

Paraphrasing a well-known proverb, one might perhaps say "show me what you have written and I will tell you who you are". Few people in the library world have been as prolific writers or even touched on as many areas as has Björn Tell.In compiling his bibliography I have had the feeling of being able to get a glimpse of the history of a personal development, an intellectual biography.

Björn Tell belongs to those generations who, instead of proceeding to studies and professional life, had to pull on a uniform and do military service for several years. His main inclination of studies - geography - placed him as a meteorologue at the Swedish Military Weather Forecasting Center. His doctoral thesis was entitled "Bioclimatology of autumn wheat - On the relation between harvest, soil temperature and rainfall at Ultuna" and it was passed at Stockholm University in 1946. This and a couple of articles published in the journal "Ymer" was as much as he had had time to produce in the area of cultural geography, when he decided to become his father's (Leander Tell) successor as head of "Biblioteksbokhandeln", a major bookshop one block away from the Royal Library.

Right from the beginning of his new career we are confronted with Björn Tell's well-nigh exuberant working energy and he becomes an ardent contributor to the professional periodical for the Swedish booktrade, viz. "Bokhandlaren" (later renamed "Svensk bokhandelstidning" and "Svensk bokhandel"). In 1947 he receives a scholarship from the publisher Bonnier and spends a year in Parisian "libraries". In 1948 he becomes editor of the journal of the "Swedish society for book trade employees" where, under the pen-name of "B. L." and "Puh", he is also a diligent contributor.

Björn Tell now takes an interest in the pricing system of the book trade and in problems of education and training for the profession. There is also a historical essay by him on the development of the system of commission in the book trade during the 1900th century. When Leander Tell subsequently decides to sell Biblioteksbokhandeln in 1949, Björn Tell joins the Library of Parliament as "amanuens". In 1952 he is nominated head librarian at the Stockholm School of Economics.

In this new position Björn Tell, as ever, seethes with craving for action. He founds the "Index for Personnel Administration", published by the Swedish Council for Personnel Administration. And foremost he opens, in the journal "Ekonomen", a review section for literature in economics under the title of "Worth reading". In each issue brief reviews of 10-15 volumes are presented, and he goes on at this pace for three years. From a host of little entries we can obviously infer a lively interest in business administration, operations research and more generally text books for the undergraduate level. He takes such liking to two books that he even takes the effort of translating them into Swedish and writing post-scripts. One is about game theory, "The compleat strategyst" by J.D. Williams, and the other is "Successful executive action" by E.C. Schleh. There are also a number of titles which later collaborators observe, with a smile of recognition, as hobby horses - already in 1956 he writes about "Please use the telecode!" And present-day users of the Lund University Library can note that as early as in 1954 he has arguments for "Mobile stacks in libraries". As if time were particularly generous to him, Björn Tell also passes an economics degree during this period.

In 1958 Björn Tell receives an international assignment to go to Venezuela in order to singlehanded work out a union catalogue of scientific periodicals. The result is "Catalogo de revistas científicas", which is published in Caracas in the following year.

During the years 1959-63 Björn Tell is head librarian at AB Atomenergi, the Nuclear Research Establishment at Studsvik. In writing his interest is now focussed on aspects of

UDC, principally the section "atomic physics" (621.039), and on the use of citation techniques as an instrument in sophisticated documentation services. His side-activities are as impressive as ever: He is principal consultant in "business administration" for the Bonnier Encyclopaedia. He starts as a diligent contributor to the Scandinavian Journal of Documentation, the journal of the Swedish Society for Technical Documentation, where he is continually elected chairman for the period 1960-1970. A heated debate on the basic ideas of Universal Decimal Classification goes on with the founder of the "Universal Classification System", Einar Wåhlin. A search in B. Tell's reviewing activities in Biblioteksbladet (the journal of the General Swedish Library Association) reveals an interest in anything from "automatic data processing in libraries" to "User studies in Vällingby", the suburb to Stockholm where he lived.

In 1963, the very year when he was nominated director of libraries at the Royal Institute of Technology in Stockholm, B. Tell conducted a "regional training course in scientific documentation for Asia" in New Delhi. On his return, he set out innovating the library which was now entrusted to his charge. Yet there remain a lot of commitments at AB Atomenergy and elsewhere to bring to a conclusion or a continuation. Also, at this stage B. Tell was a member of about thirty boards and committees. Among international assignments, which only tend to become more exacting, one might here mention just a few like that of a Swedish deleguee in the "OECD committee for scientific research: ad hoc group on scientific and technical information policy", later the IPG, where he acted as vice chairman, the chairmanship in the "ISO Working group 46: secretariat for data formats in libraries" and the "OECD/ENEA task group on the distribution of reports in the nuclear energy field". Largely as a result of Björn Tell's involvement in the OECD information policy activities a network of national focal points, among which is the Swedish Council for Scientific Information and Documentation (SINFDOK), was established in Europe.

In 1964 Björn Tell was called in by Pierre Auger, director general of ESRO, to participate in the "Documentation Consultative Committee". Tell was active in promoting the development of the ESRO/RECON network for on-line documentation services, and succeeded in establishing a permanent telecommunication link with the RIT Library. In 1976, when ESRO was transformed into ESA (European Space Agency), he was asked to chair its "Documentation advisory group". In this forum he has promoted the establishment of an "Ad hoc working group on use of communications satellites for documentation (COSADOC)". One of the more spectacular projects to be tested in the late 1970s is concerned with broadhand transmission for document and picture distribution.

B. Tell also has been extremely active in the OECD, where in 1965, on the suggestion of Bror Rexed, he was nominated Swedish delegate to the working group associated with the OECD Committee for Scientific Research. This group was later made permanent under the name of Scientific and Technical Information Policy Group (IPG), where Tell was elected vice chairman.

The year 1967 marks the beginnings of the information and documentation centre (IDC) at the Royal Institute of Technology Library (RITL), which rapidly gains international recognition for its comprehensive services and advanced R & D projects. The first efforts in SDI-services (current awareness services based on individual profiles of research interests) were carried out using the ABACUS system, originally developed for bibliographical listings, accessions lists etc. The development of I & D services became Björn Tell's favourite occupation and concern. The software soon evolved into general systems for literature search. The latest addition is the 3RIP-system resulting from a major R & D-project headed by R. Larsson at RITL and financed by SINFDOK.

Björn Tell's international contacts also led to an exchange of experiences with prominent centres in the scientific and technical I & D community. One is the Institute for Scientific Information in Philadelphia. Another is the

Institution of Electrical Engineers (UK), which produces the INSPEC data base and the phototypeset secondary publications "Science Abstracts" and "Current Papers". Such contacts gave many impulses, for example phototypesetting from 1970 on of LIST TECH, the Swedish union list of periodicals in science and technology, produced at RITL.

Apart from all this, the usual intense publishing rate continues as before. In the Swedish Journal of Documentation and in Biblioteksbladet appear reviews signed B. Tell of most books of any importance in the I & D field. Ironically (for the editors of this volume) he, en passant, can reject the whole idea of Festschriften as unproductive.

From 1969 onwards he participates as a handpicked leading European expert in the OECD Secretary General's Ad Hoc Group on Scientific and Technical Information, where he served as rapporteur, and in the development of the international UNISIST program. With such commitments as an international basis and through his membership in SINFDOK at home, he has continued to act as a pioneer in the development of computer applications in libraries and in I & D activities.

In a presentation of this kind it is easy to highlight the more exotic and spectacular activities and to forget about the daily tasks which after all comprise most of the time-consuming responsibilities. And in the case of Björn Tell it is particularly easy to revert to such a biased representation. Who else in our country would, for example, go to spend a month planning an information network for Yugoslavia, "a country with ten languages and four religions". Who else would have a national seminar named after him in Australia (The Tell seminar).

In 1973 B. Tell was nominated Director of libraries at Lund university. This ends our daily professional contacts and since then I have only been able to follow his activities from a proper distance. A new report series, LUNDD-LIB is created at the university library along with an effort, in the style of the TRITA-reports at the Royal Institute of Technology, to create a unified system for the report production of all institutions at Lund university. The publications now, more than earlier, resemble those of a "normal" head librarian. To quote just a few examples, there are articles on the creation of the new library annex, UB 2 or "LUBBIS", and large committee reports for BIDOK, the "Government Commission on the Coordination of the Libraries and Documentation Services" (1975-1977). He returns twice to Venezuela, where he supervises the foundation of a national system for scientific and technical information (his latest visit was in May 1978). Malaysia and Indonesia? He was there in 1976 and 1978 on UNESCO missions. And during the past few years he has devoted a lot of energy and ingenuity to the development of NATIS (the UNESCO program on national information systems).

A couple of editorial principles used for the bibliography might be called to attention. The material is sorted according to the year of publication and within one year the following order is pursued:

1) Separate publication in alphabetical order
2) Journal articles in alphabetical order
3) Reviews with a title and minor contributions to journals and newspapers in alphabetical order
4) Brief reviews in alphabetical order (according to author or title of reviewed book).

The bibliography is concluded by a list of books appearing in B. Tell's review section in the journal Ekonomen, during the period 1955-59.

An active, not to say a passionate life. It has been a true joy to compile this bibliography. Inga Claesson and Björn Tell have been extremely helpful. Stefan Svanström at RITL should have due credit for the software package that has been the basis for production of the data file and for continual technical support. As technical facilities we have used an Incoterm SPD 10/20 terminal with two diskette drives, and a Diablo printer with an Elite-12 type wheel.

A Bibliography of Björn V. Tell

Edited by Ola Palmaer

1943

1. Ett 25-årsjubileum.
   BMF 25(1943):1 s.1.

2. Invasionshot.
   Bokhandlaren. 36(1943):5 s.26.

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3. Torsten Forsman +.
   BMF 26(1944):6 s.16.

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4. Boken som gåva.
   BMF 27(1945):1 s.16.

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5. Höstvetets bioklimat. Om höstveteskördens samband med jordtemperatur och nederbörd vid Ultuna. (Fil.lic.avhandling vid StockStockholms Högskola.)
   Ymer 66(1946):1-4 s.273-302.

6. Rec.av I. Hustich, Om det nordfinska jordbrukets utveckling och årliga produktionsvariationer. (Fennia 62:2 Helsingfors 1945.)
   Ymer 66(1946):1-4 s.238.

1947

7. A cond. och f.r. inom fransk bokhandel.
   Bokhandlaren 40(1946):50 s.331.

1948

8. Bokproduktion och bokspridning.
   BMF 30(1948):6/7 s.4-5

9. Böcker är vapen.
   BMF 30(1948):5 s.12-13.

10. Elevutbildningens förfall.
    BMF 30(1948):6/7 s.3-4,6.

11. Engelsk bokhandel ingen affär.
    BMF 30(1948):6/7 s.13-17.

12. Från medhjälpare till bokhandlare.
    BMF 30(1948):8 s.3-4.

13. Första etappen.
    BMF 30(1948):5 s.3-4.

14. Ett klassiskt barnbibliotek.
    BMF 30(1948):8 s.16-17.

15. Kolgruvearbetare eller bokhandelsmedhjälpare.
    BMF 30(1948):2 s.3.

16. Kungsbokhandeln.
    BMF 30(1948):5 s.5-7.

17. Nordisk bokhandelshögskola.
    BMF 30(1948):5 s.8-9.

18. Normer och avtal.
    BMF 30(1948):9 s.3-6.

19. Som volontär i Parisatmosfär.
    BMF 30(1948):1 s.17-19.

20. Underskattar man marknaden för god litteratur?
    BMF 30(1948):2 s.18.

21. Vår ställning 1948.
    BMF 30(1948):1 s.3-4.

1949.

22. Aktiebolag och bokhandelsprivilegier.
    BMF 31(1949):1 s.3-4.

23. Aktiebolag och privilegier.
    BMF 31(1949):2 s.4.

24. BMF:s resestipendier.
    BMF 31(1949):1 s.6-8.

25. Bokhandlare Josephsons hjärnspöke.
    BMF 31(1949):2 s.19.

26. Bookshop training in Sweden. A 12-week instructional course for assistants.
    Bookseller 1949:June 11.

27. En fullföljd bokhandelsutbildning.
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28. Initiativ som väntas.
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29. Kommissionsbokhandelns utveckling efter 1800.
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30. Ny giv - bättre kort. Hålkortsmaskiner i Nordiska bokhandeln.
    BMF 31(1949):4 s.8-10,12.

31.Den sköna och den goda boken.
BHF 31(1949):4 s.3

32.Snabbkurs i redovisning.
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33.Svenska folket på abc-stadiet? Referat av bokutredningens arbete.
BHF 31(1949):5/6 s.7-9.

34.Välkomna till Sigtuna.
BHF 31(1949):5/6 s.3.

35.En ökad bokförsäljning genom bättre "Public relations" inom bokhandeln?
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36.Rec.av F.Lägnert, Veteodlingen i södra och mellersta Sverige. Akademisk avhandling.
Ymer 70(1950):1-4 s.221-223.

37 Samverkan och individuell service.
Svensk bokhandelstidning 98(1950):19 s.149.

38.Skatteredovisningsteknik.
Svensk bokhandelstidning 98(1950):6 s.38.

39.Vad engelska pojkar läser.
Svensk bokhandelstidning 98(1950):8 s.51.

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40.Bokhandeln och bruttoprissystemet.
Svensk bokhandelstidning 99(1951):43 s.282-284.

41.Bruttoprissystemet i blåsväder.
Svensk bokhandelstidning 99(1951):45 s.308.

42.Bruttoprissystemet och bokhandeln.
Svensk bokhandelstidning 99(1951):44 s.292-295.

43.Böcker och priser.
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44.Nyetableringsmöjligheterna och bokhandeln.
Svensk bokhandelstidning 99(1951):39 s.242-244,246-248.

45.Psykologiskt försvar och bokutgivning.
Svensk bokhandelstidning 99(1951):20 s.132.

46.Sven Rinmans disputation.
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49.Amerikanska bokhandelssiffror.
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50.Bokförsäljning genom bibliotek.
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51.Funderingar kring bokhandelns kostnader.
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52.Ny referattidskrift för ekonomin.
Tidskrift för dokumentation 9(1953):3 s.51-52.

53.Utbildningens betydelse.
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54.Om masskommunikation.
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55.Snabbkurs i ledarskapets konst. Rec.av A.O.Berg och J.O.Sack, Ledarskap i samverkan. Stockholm 1953.
Ekonomen 29(1953):4 s.33.

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56.Företagsledning och företagskontroll. Selektiv bibliografi. Handelshögskolans bibliotek. Stockholm. 1954. 52 s.

57.Adresseringsmaskin i katalogarbetet.
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59. Dansk bokhandlarekonomi.
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60. Om klassifikation på UDK-grupperna 59 och 65.
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61. Rörliga hyllor i bibliotek. Några synpunkter på problemet.
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62. Synpunkter på premiering av försäljningspersonal.
Svensk bokhandel 3(1954):13 s.311-312,314.

1955

63. Personaladministrativ index. Utg.av PA-rådet, Stockholm. - Grundad av Björn Tell, som var dess redaktör åren 1955-59.

64. Bestsellers och den ekonomiska teorin.
Svensk bokhandel 4(1955):35 s.771-773.

65. Internationell samordning av bokstatistiken.
Svensk bokhandel 4(1955):42 s.988-989.

66. Lönande lösning.
Industria 51(1955):7/8. s.23-25.

67. Mikrofilmtekniken och biblioteken.
Tidskrift för dokumentation 11(1955):5 s.49-54.

68. Om xerografi.
Tidskrift för dokumentation 11(1955):1 s.5-7.

69. Storbriftsformer inom bokhandeln. Tvärsnitt genom engelsk bokhandel under senare år.
Svensk bokhandel 4(1955):3 s.46-48.

70. Konsten att läsa snabbt. Rec.av B.Grön: Konsten att läsa snabbare.
Tidskrift för dokumentation 11(1955):6 s.69.

71-119. Björn Tell skrev och redigerade under åren 1955-1957 en artikelserie under rubriken Värt att läsa. Böcker, artiklar i tidskriften Ekonomen. Efter bibliografin följer en lista över ett urval böcker, som recenserades eller omnämndes utförligare i denna artikelserie. Siffrorna inom parentes hänvisar till respektive nummer i listan.

71. Allvarliga tankar om företagsledning.
Ekonomen 31(1955):7 s.30.

72. Att handla i stan eller i förortens shoppingcentrum.
Ekonomen 31(1955):7 s.31.

73. Automation på kontor.
Ekonomen 31(1955):1 s.11.

74. Avbetalningarnas räntaproblem.
Ekonomen 31(1955):8 s.40.

75. Bedrägeri hos Lloyds.
Ekonomen 31(1955):1 s.11.

76. [illegible]
Ekonomen 31(1955):7 s.31,33.

77. Bolag på löpande band i standardutförande.
Ekonomen 31(1955):7 s.33.

78. Diagnos av köpmotiv.
Ekonomen 31(1955):6 s.23.

79. Direktförsäljning till industrin.
Ekonomen 31(1955):6 s.26.

80. Dör cheferna för tidigt?
Ekonomen 31(1955):1 s.12.

81. Ekonomisk risk och resultatberäkningar. (116)
Ekonomen 31(1955):6 s.24.

82. Ekonomiskt forum - samlingsplats och prestigeorgan.
Ekonomen 31(1955):4 s.32,34.

83. Elektroniken och rederinäringen.
Ekonomen 31(1955):7 s.31.

84. Elektronikexpert medföljer i maskinen.
Ekonomen 31(1955):8 s.39.

85. Enformighet och [illegible].
Ekonomen 31(1955):7 s.31.

86. Engelsk bok för företagsledare. (5)
Ekonomen 31(1955):8 s.39.

87.[illegible]

88.[illegible]

89.[illegible]

90.[illegible]

91.[illegible]

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93.[illegible]

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122.[illegible]

123.[illegible]

124. Passerar ni på mikrofotograferingen? Rec. av C.M. Lewis och W.H. Offenhauser Jr, Microrecording, industrial and library applications. New York 1956.
Tidskrift för dokumentation 12(1956):5 s.63.

125-[illegible]. Följande rubriker har förekommit i artiklar från och med 1955 i tidskriften Ekonomen vol. 32(1955)-

125. Affärsföretaget som finansieringskälla. (10)
Ekonomen 32(1955):20 s.32.

126. Aktuella exportproblem.
Ekonomen 32(1955):2 s.32.

127. [illegible] och redovisningen.
Ekonomen 32(1955):12 s.27,28.

128. Amerikanska företagsledare i [illegible]. (50)
Ekonomen 32(1955):7 s.35.

129. Amerikansk [illegible]. (10)
Ekonomen 32(1955):13 s.33-34.

130. [illegible].
Ekonomen 32(1955):11 s.36.

131. Att tjäna två herrar - Företaget och fackföreningen.
Ekonomen 32(1955):1 s.30.

132. Automatisering. (63)
Ekonomen 32(1955):16 s.31,42.

133. Automation och den [illegible]. (71)
Ekonomen 32(1955):8 s.22-23.

134. Automationslitteratur.
Ekonomen 32(1955):12 s.42.

135. [illegible] i Sydafrika.
Ekonomen 32(1955):13 s.30.

136. Bank och [illegible]. (10)
Ekonomen 32(1955):20 s.31-32.

137. [illegible] i [illegible]. (70)
Ekonomen 32(1955):2 s.30.

138. Behöver vi [illegible]?
Ekonomen 32(1955):12 s.27.

139. Bidrag till [illegible] historia. (?)
Ekonomen 32(1955):2 s.30-31.

140. Bilskatter och landsvägsbyggandet. (50)
Ekonomen 32(1955):7 s.33-34.

141. "Den mål" om företagsledning.
Ekonomen 32(1955):3 s.35.

142. Det [illegible]?
Ekonomen 32(1955):18 s.35-36.

143. [illegible] i [illegible].
Ekonomen 32(1955):20 s.35.

144. Demokratiseringsprocessen och [illegible].
Ekonomen 32(1955):1 s.30.

145. Detaljhandelns reklamproblem.
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146. Direktförsäljning från tung industri.
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147. [illegible] av två slag. (30)
Ekonomen 32(1955):20 s.33.

148. Då saken är borta...
Ekonomen 32(1955):6 s.33.

149. Effektiv budgetering.
Ekonomen 32(1955):13 s.27.

150. [illegible].
Ekonomen 32(1955):17 s.33,35.

151. Ekonomiska [illegible].
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152. Elektroniken och industrin.
Ekonomen 32(1955):1 s.30.

153. En [illegible] i [illegible] - [illegible] i försäljning.
Ekonomen 32(1955):11 s.35.

154. Engelskt [illegible]. (?)
Ekonomen 32(1955):6 s.30.

155. Erfarenheter av [illegible]. (50)
Ekonomen 32(1955):17 s.34-35.

156. [illegible] och god tro.
Ekonomen 32(1955):12 s.27.

157. Export av [illegible].
Ekonomen 32(1955):3 s.33-34.

158. Festskrift till Erik Lindahl.
Ekonomen 32(1955):20 s.35.

159. Festskrift till [illegible]. (25)
Ekonomen 32(1955):11 s.27.

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236.Statistikbeställaren och statistikern.
Ekonomen 32(1956):12 s.29-30.

237.Systemundersökningar till grunden.
Ekonomen 32(1956):20 s.36.

238.Säljteknik.
Ekonomen 32(1956):10 s.37.

239.Telefonvett.
Ekonomen 32(1956):9 s.27.

240.Transportproblem och operationsanalys.
Ekonomen 32(1956):5 s.27-28.

241.Transportteori. (5)
Ekonomen 32(1956):8 s.27.

242.Utländska agenter - [illegible] som fordrar [illegible].
Ekonomen 32(1956):5 s.30-31.

243.Utnyttja telex. (75)
Ekonomen 32(1956):10 s.34.

244.Utrikeshandel och handelspolitik.
Ekonomen 32(1956):8 s.33.

245.Utvecklingen på distributionsområdet.
Ekonomen 32(1956):3 s.34.

246.Val av investeringsalternativ. (22)
Ekonomen 32(1956):9 s.28.

247.Val av reklammedia. (36)
Ekonomen 32(1956):20 s.35-36.

248.Valutaregleringen nu kommenterad.
Ekonomen 32(1956):1 s.30-31.

249.Vetenskapliga förklaringsgrunder. (11)
Ekonomen 32(1956):8 s.25-26.

250.Vi gör en ny produkt.
Ekonomen 32(1956):6 s.32.

251.Vidareutbildning för dem som skall vidare. (76)
Ekonomen 32(1956):6 s.35-36.

252.Är er annons övertygande?
Ekonomen 32(1956):5 s.31.

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253.Biblioteksorganisation. En studie av de administrativa principer och deras tillämpning i nutida bibliotek. Stockholms handelshögskolas bibliotek. Examensarbeten 1958:1. 35,(10) s.

254.Fyrspråkig förteckning över huvudbegreppen inom företagsekonomin. (Svensk text.) Stockholm 1957. 13 s.

255.Företagets anställnings- och utbildningsfrågor. Personnel selection and development. En selektiv och refererande litteratursammanställning. Stockholms handelshögskolas bibliotek. Stockholm 1957. 42 s.(Bibliografi 1957:8.)

256.Williams, J.D., Den fulländade strategen. Översättning och slutord av Björn Tell. Stockholm 1957.

257.Biblioteken och [illegible].
Tidskrift för dokumentation 13(1957):4 s.40-41.

258.Biblioteksstatistikens omarbetning.
Tidskrift för dokumentation 13(1957):4 s.37-39,40.

259.Kan bibliotekens effektivitet mätas?
Tidskrift för dokumentation 13(1957):3 s.33-34.

260.Maskinell litteratursökning efter nya linjer. Rec.av J.W. Perry, A.Kent and M.M.Berry, Machine literature searching.
Tidskrift för dokumentation 13(1957):2 s.19-21.

261.Organisationsklassen i [illegible] (UDC 65).
Tidskrift för dokumentation 13(1957):5 s.55.

262.Stencilapparat för katalogkort.
Tidskrift för dokumentation 13(1957):2 s.23.

263-279.Följande rubriker har förekommit i krönikan Värt att läsa i tidskriften Ekonomen vol.33(1957):

263.En administrationsklassiker. (65)
Ekonomen 33(1957):6 s.40-41.

264.Aktuell kunskap.
Ekonomen 33(1957):5 s.35.

265.Alvin Hansen, keynesianismen och Knut Wicksell. (34)
Ekonomen 33(1957):13 s.27-28.

266.Annonsering för småindustrin.
Ekonomen 33(1957):13 s.30-31.

267.Arbetet i en affärsbank.
Ekonomen 33(1957):7 s.43.

268.Arbetsledarteknik.
Ekonomen 33(1957):2 s.37.

269.Automation för lekmän.
Ekonomen 33(1957):12 s.31.

270.Automation för samhällsvetenskapare.
Ekonomen 33(1957):12 s.32.

271.Automation för tekniker.
Ekonomen 33(1957):12 s.31.

272.Det automatiserade kontoret.
Ekonomen 33(1957):2 s.31-32.

273.Begynnande tysk administrationsfilosofi?
Ekonomen 33(1957):12 s.33-34.

274.Bibliografi för linjär programmering.
Ekonomen 33(1957):8 s.47.

275.Bokföringsteknikens utveckling. (67)
Ekonomen 33(1957):13 s.29-30.

276.Budgetering och inkomstplanering. (28)
Ekonomen 33(1957):14 s.35.

277.De bästa böckerna om den fria världens ekonomi.
Ekonomen 33(1957):4 s.35.

278.Bättre reklam. (44)
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279.Centralisering contra decentralisering.
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280.Distribution och vetande.
Ekonomen 33(1957):18 s.30.

281.Djungeltelegrafen kan utnyttjas konstruktivt.
Ekonomen 33(1957):15 s.37-39.

282.Du Pont - ett verk av generationer goda företagare.
Ekonomen 33(1957):12 s.32.

283.Efterfrågeanalysen - ett verktyg för marknadsforskningen? (41)
Ekonomen 33(1957):6 s.41-42.

284.Ekonometri och nationalekonomi. (26)
Ekonomen 33(1957):11 s.25-27.

285.Ekonomisk företagsledning.
Ekonomen 33(1957):10 s.29.

286.Ekonomisk vetenskap och politik.
Ekonomen 33(1957):8 s.44.

287.Ekonomisk översikt.
Ekonomen 33(1957):5 s.38.

288.Ekonomiska dagsfrågor.
Ekonomen 33(1957):4 s.27.

289.Ekonomiska koncentrationssträvanden. (46)
Ekonomen 33(1957):9 s.42.

290.Ekonomiskt forum 1957.
Ekonomen 33(1957):13 s.31.

291.Engelsk marknadsforskning.
Ekonomen 33(1957):18 s.30.

292.Femhundra böcker aktuell ekonomi.
Ekonomen 33(1957):3 s.35.

293.Finis HHS studiehandbok.
Ekonomen 33(1957):20 s.29.

294.Firmakatalogen som försäljning.
Ekonomen 33(1957):7 s.41.

295.Forskning och produktionsutveckling.
Ekonomen 33(1957):4 s.28.

296.Franska brev och meddelanden.
Ekonomen 33(1957):7 s.42.

297.Fusion och skatter.
Ekonomen 33(1957):5 s.38.

298.Fyra arbeten i kostnadsintäktslära.
Ekonomen 33(1957):1 s.37.

299.För finansieringsstudierna.
Ekonomen 33(1957):20 s.30.

300.För industri- och företagsarkiv. (29)
Ekonomen 33(1957):1 s.35.

301.För utländska gäster.
Ekonomen 33(1957):12 s.31.

302.Företaget och kreditmarknaden.
Ekonomen 33(1957):12 s.32.

303.Företagsarkivet.
Ekonomen 33(1957):12 s.32-33.

304.Företagsekonomi II.
Ekonomen 33(1957):18 s.29-30.

305.Företagsekonomi av gammal god årgång.
Ekonomen 33(1957):18 s.27.

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306.Företagsekonomin i nya studieorganisationen.
Ekonomen 33(1957):17 s.29-34.

307.Företagsledarkonferens.
Ekonomen 33(1957):2 s.37.

308.Företagsvinsten i populär framställning.
Ekonomen 33(1957):4 s.28.

309.Förhållandet mellan linjen och staben.
Ekonomen 33(1957):15 s.38.

310.Försäljaren och kunderna.
Ekonomen 33(1957):20 s.32.

311.Gillessocialism i ny upplaga.
Ekonomen 33(1957):7 s.43.

312.Grosshandelbokföring.
Ekonomen 33(1957):4 s.27.

313.Handlingsplaner och systemanalys.
Ekonomen 33(1957):7 s.42.

314.Harvard economic studies.
Ekonomen 33(1957):9 s.40,42.

315.Hemlighetsmakeri eller fri insyn.
Ekonomen 33(1957):18 s.29.

316.Högre matematik på annat sätt.
Ekonomen 33(1957):15 s.37.

317.Icke blott värda att läsa utan även att äga.
Ekonomen 33(1957):12 s.34.

318.Idéhistoria med Keynes och Wicksell.
Ekonomen 33(1957):16 s.55.

319.Individualitet och stämpelur.
Ekonomen 33(1957):10 s.29.

320.Intern revision.
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Ekonomen 33(1957):4 s.32.

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344.Nyheter i statistik.
Ekonomen 33(1957):18 s.27,29.

345.Om Ricardo.
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Ekonomen 33(1957):14 s.36.

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Ekonomen 33(1957):12 s.34,37.

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Zürich

Göteborg University Library

Halmstad County Library

Högskolan, Borås

Högskolan, Kristianstad

Högskolan, Örebro

Jernkontoret
Stockholm

Kamratföreningen, Lund University Library

Karolinska Institutet
Stockholm

Kommunstyrelsen, Växjö

Krigsarkivet, Stockholm

Kungliga Biblioteket
Stockholm

Kungl Tekniska Högskolan
Stockholm

Kyrkohistoriska arkivet
Lund

Landsarkivet, Lund

Library of Veterinary Science
Skara

Linköping University Library

Lund Public Library

Lund University Library

Malmö Public Library

Ministry of Education
Stockholm

Mo och Domsjö AB, R & D
Library, Örnsköldsvik

Norges Tekniske Högskole,
Library
Trondheim, Norway

Norrköping Public Library

Norrtälje Public Library

Norsk Senter for Informatikk
Blindern, Norway

OECD - Nuclear Energy Agency,
Library
Paris

AB Rekolid
Stockholm

Riksdagsbiblioteket
Stockholm

SAAB-SCANIA AB,
Aircraft division
Linköping

SAAB-SCANIA AB
Personnel division, Library
Trollhättan

SAAB-SCANIA AB,
Scania division
Södertälje

SCA Teknik Library
Sundsvall

Stifts- och landsbiblioteket,
(County Library)
Linköping

Stifts- och landsbiblioteket
(County Library)
Skara

Stockholm City Archives

Stockholm University Library

Sundsvall Public Library

Svenska Institutet
Stockholm

Södertälje Public Library

TCO Library
Stockholm

Tekniska Nomenklaturcentralen
Stockholm

Uppsala University Library

AB Volvo, Library
Göteborg

Västerås Public Library

Örebro Municipality